SOIL SURVEY OF

Steuben County, New York

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Cornell University
Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1958–1971. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Cornell University Agricultural Experiment Station. It is part of the technical assistance furnished to the Steuben County Soil and Water Conservation District. Financial assistance was provided by the Steuben County Board of Supervisors.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Steuben County are shown on the detailed map at the back of this survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbol. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the woodland subclass in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions.

Foresters and others can refer to the section "Woodland Management and Productivity," where the soils of the county are rated according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife Habitat."

Community planners and others can read about soil properties that affect the choice of sites for dwellings and recreation areas in the section "Engineering."

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties significant to engineering, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Steuben County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County."

Cover: A vineyard in Mardin-Ovid-Lordstown association.

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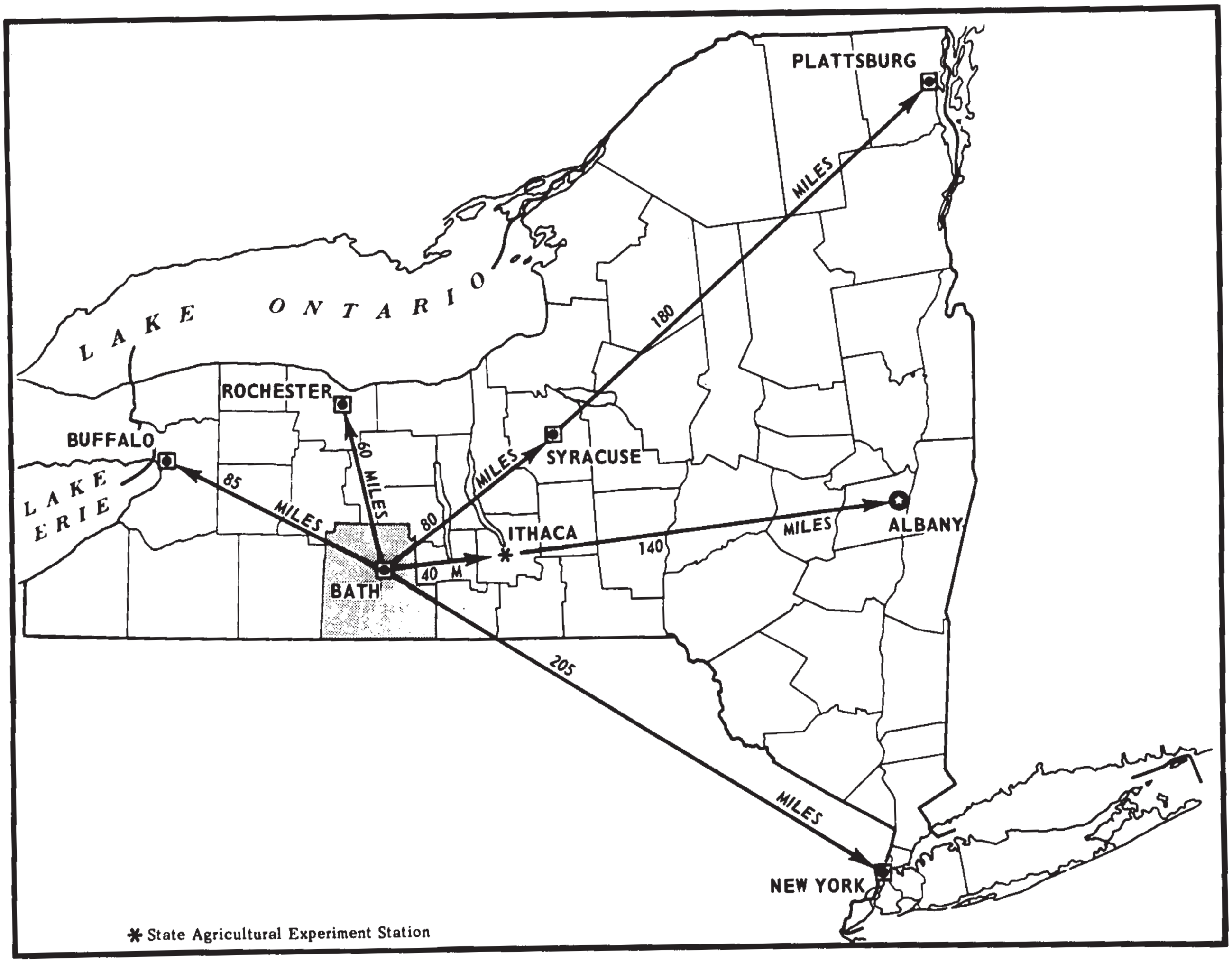

Location of Steuben County in New York.

SOIL SURVEY OF STEUBEN COUNTY, NEW YORK

By Lewis M. French, John P. Wulforst, William A. Broad, and Paul R. Bauter, Soil Conservation Service, and Richard L. Guthrie, Cornell University Agricultural Experiment Station

United States Department of Agriculture, Soil Conservation Service, in Cooperation with the Cornell University Agricultural Experiment Station

STEUBEN COUNTY is in the south central part of New York State. It is one of the southern tier counties that adjoin the New York-Pennsylvania State line. It is bounded on the east by Chemung and Schuyler Counties; on the north by Livingston, Ontario, and Yates Counties; and on the west by Allegany County. Steuben County has an area of about 901,120 acres or about 1,408 square miles.

Most of the county is farmland. About 10 percent is urban land or is in public ownership. Somewhat less than half of the farmland is in crops. The county's best farm areas include hills and valleys in the north and valleys in the south.

Dairying is the dominant type of farming. Potato production is centered in the northern part of the county, grapes are grown on the slopes adjacent to Keuka Lake, and onions are grown on muck soils near Arkport and Prattsburg. Grain crops and maple products are also important.

Just under half the county is in forest. Most of these wooded areas are scattered throughout, mostly on the steeper slopes.

The soils on most uplands formed in glacial till. The dominant limitations are slope and seasonal wetness. The valley sections are dominated by soils that formed in glacial outwash or alluvial sediments. Occasional wet spots or flood hazard are the major problems associated with soils in these valleys.

Considerable areas that were farmed in the past are now being used for recreation, especially those areas in the uplands.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Steuben County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons of all the soils of one series are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Alton and Bath, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Volusia channery silt loam, 3 to 8 percent slopes, is one of several phases within the Volusia series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of

soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Steuben County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Howard-Dunkirk complex, hilly, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Lordstown-Arnot association, steep, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Howard and Alton gravelly soils, 20 to 30 percent slopes, is an example.

In most survey areas there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey. Ochrepts and Orthents is an example in Steuben County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Steuben County. A soil association is a landscape that has a distinctive proportional pattern of soils. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know how to find suitable sites for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreation facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting a site for a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into six general kinds of landscapes for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages.

The Steuben County general soil map does not join with those of the Allegany, Chemung, Ontario and Yates, and Schuyler Counties, because these were published at a different scale. Also, the concepts and names of some series have changed as a result of changes in the classification system since the soil surveys of Allegany, Chemung, Ontario and Yates, and Schuyler Counties were published.

Dominantly Moderately Deep and Shallow Soils That Formed in Thin Glacial Till Deposits

The soils in the two associations of this group are on hillsides on the uplands. They cover 19.1 percent of the county. These soils are moderately deep and shallow over bedrock, well drained to somewhat poorly drained, and moderately steep to very steep.

1. Hornell-Lordstown association

Moderately steep to very steep, somewhat poorly drained, moderately deep soils overlying soft shale bedrock and well drained, moderately deep soils overlying hard sandstone bedrock; on uplands

This association is on steep hillsides along the Canisteo River Valley and its major tributaries where

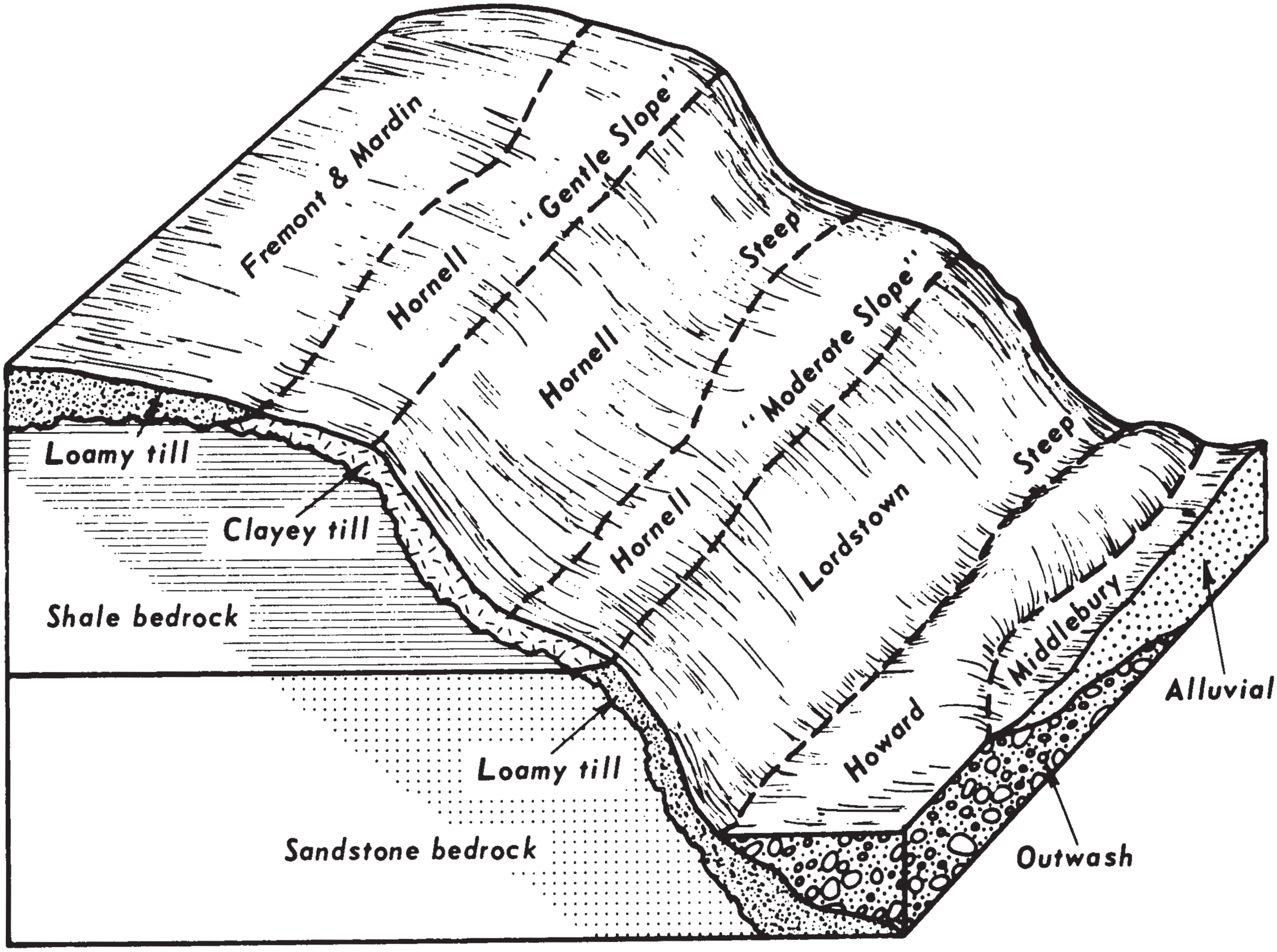

Figure 1.—**Relationship of soils and underlying material in Hornell-Lordstown association.**

the underlying bedrock affects the relief. Along the central part of the main valley the upper side wall rims are extremely steep or gorgelike (fig. 1).

This association makes up 7.3 percent of the county. It is about 30 percent Hornell soils, 25 percent Lordstown soils, and 45 percent minor soils.

Hornell soils are moderately deep over shale bedrock and are somewhat poorly drained. These soils formed in till that is high in clay content and are moderately steep and steep on hillsides. Lordstown soils are moderately deep over sandstone bedrock and are well drained. These soils formed in till and are steep or very steep on hillsides.

The minor soils in this association are Arnot, Mardin, Fremont, and Kanona soils. Arnot soils are shallow to rock, Mardin soils are moderately well drained, Fremont soils are somewhat poorly drained, and Kanana soils are poorly drained and somewhat poorly drained. Also included are small areas of rock outcrop on the steep side walls of valleys. An important part of this association is a narrow band of minor soils on flood plains and outwash terraces adjacent to the Canisteo River.

Most areas of this association are in trees. A few of the less sloping areas were once cleared and farmed, but most are now idle and reverting to brush. A few of these areas are severely eroded, and vegetation is sparse. The steep and very steep slopes and moderate depth to bedrock of the major soils are limitations to both farm and nonfarm uses.

2. *Lordstown-Arnot association*

Steep and very steep, dominantly well drained, moderately deep and shallow soils overlying hard sandstone bedrock; on uplands

This association is on the steep and very steep hillsides along the Cohocton River Valley and most of its major tributaries. South of the city of Corning it is on the sides of the Chemung River Valley.

This association makes up 11.8 percent of the county. It is about 45 percent Lordstown soils, 30 percent Arnot soils, and 25 percent minor soils.

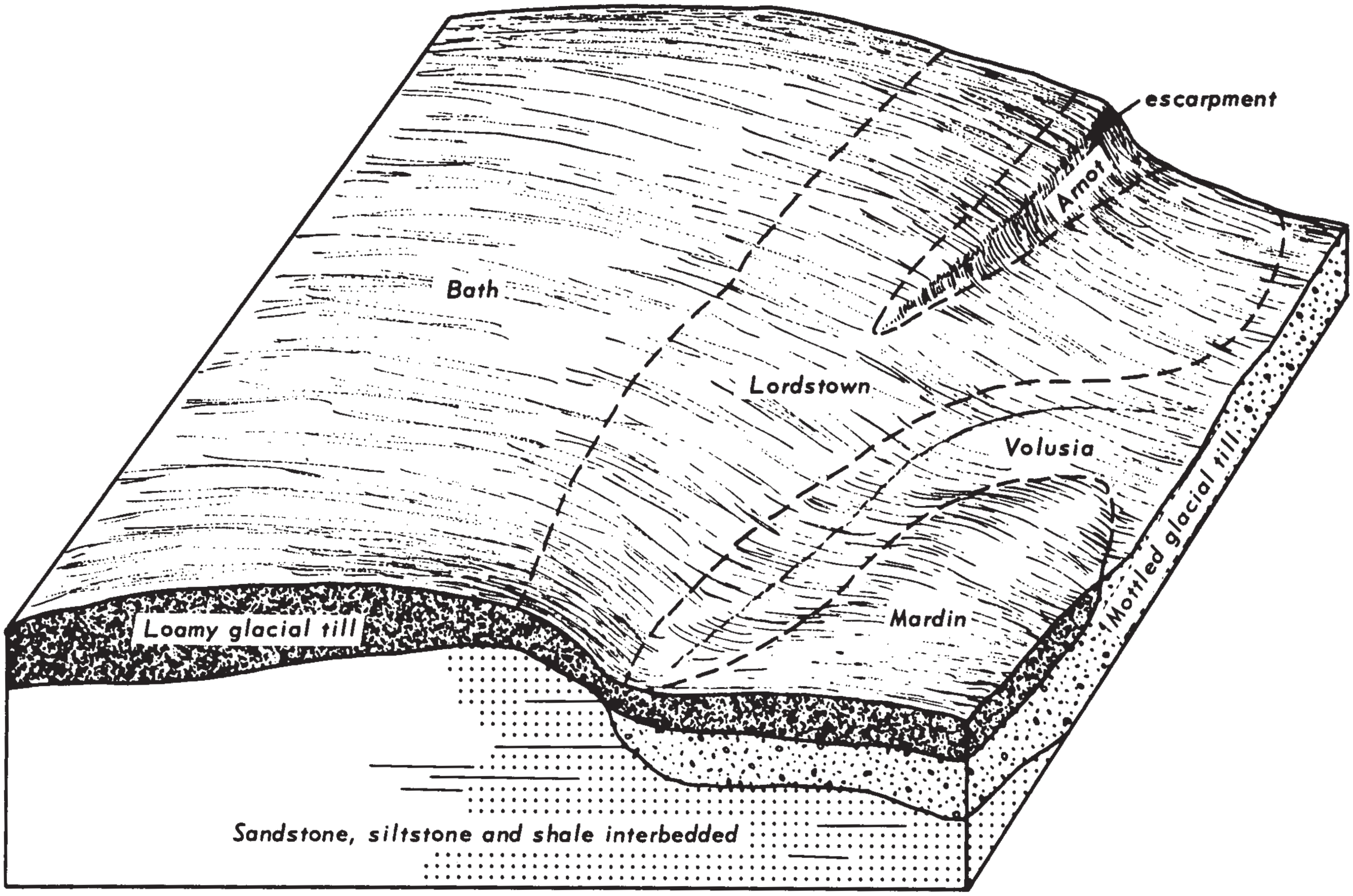

Figure 2.—**Relationship of soils and underlying material in Bath-Lordstown association.**

Lordstown soils are moderately deep over sandstone bedrock and are well drained. These soils formed in till and are steep or very steep on hillsides.

Arnot soils are shallow over sandstone bedrock and are well drained and moderately well drained. These soils formed in till and are steep or very steep on hillsides.

The minor soils in this association are Bath and Mardin soils. Bath soils are well drained and Mardin soils are moderately well drained. Narrow belts are along streams of soils on flood plains and outwash terraces.

Most areas of this association are in trees. A few areas that were once cleared are now mainly idle and are reverting to brush. Many of the higher areas have scenic valley overlooks. Steep and very steep slopes and shallowness to bedrock are limitations to most uses.

Dominantly Deep Soils That Have a Fragipan and That Formed in Glacial Till

The soils in the five associations of this group are on uplands. They cover 56.2 percent of the county. These soils are dominantly deep, well drained to somewhat poorly drained, and gently sloping to steep. They have a firm fragipan that restricts root growth and slows the downward movement of water.

3. Bath-Lordstown association

Gently sloping and sloping, well drained, deep soils that have a fragipan and moderately deep soils overlying hard sandstone bedrock; on uplands

This association is on gently sloping and sloping hilltops in the north-central part of the county. These plateau tops are narrow and deeply dissected, especially where they are adjacent to the main valleys (fig. 2).

This association makes up 6.2 percent of the county. It is 35 percent Bath soil, 30 percent Lordstown soils, and 35 percent minor soils.

Bath soils are deep and well drained. These soils have a dense, slowly permeable fragipan at a depth of 26 to 36 inches. They formed in till and are gently sloping or sloping on hilltops.

Lordstown soils are moderately deep over sandstone bedrock and are well drained.

The minor soils in this association are Arnot, Mardin, and Volusia soils, and a narrow strip of soils on flood plains. Arnot soils are shallow, well drained

and moderately well drained; Mardin soils are moderately well drained; and Volusia soils are somewhat poorly drained.

Most areas of this association have been cleared and are used for potato production or dairy farming. The good drainage of the major soils allows early tillage, which is beneficial to potatoes. The major soils are generally favorable for building foundations. Depth to a slowly permeable fragipan or to bedrock and in places the slope are the soil features that affect most uses.

4. *Mardin-Ovid-Lordstown association*

Gently sloping to moderately steep, moderately well drained soils that have a fragipan; moderately well drained and somewhat poorly drained, deep soils; and sloping to steep, well drained, moderately deep soils overlying sandstone bedrock; on uplands

This association is on long side slopes of the plateau near Keuka Lake. Most of the slopes are gentle or moderate, but they are steeper near the lake shore. Practically all the soils slope toward the lake. Numerous very narrow gullies, some of which are deeply entrenched, dissect much of this association.

This association makes up 1.8 percent of the county. It is about 40 percent Mardin soils, 15 percent Ovid soils, 15 percent Lordstown soils, and 30 percent minor soils.

Mardin soils are deep, moderately well drained, and have a fragipan. These soils formed in till and are gently sloping to moderately steep on hillsides. In many areas they are eroded.

Ovid soils are deep and moderately well drained and somewhat poorly drained. These soils have the highest clay content within the association. They formed in till and are gently sloping or sloping. In many areas they are eroded.

Lordstown soils are steep or moderately steep, moderately deep over bedrock, and are well drained. These soils formed in till adjacent to the lakeshore.

The minor soils in this association are Arnot, Chenango, Tuller, and Volusia soils. Arnot soils are well drained and Tuller soils are somewhat poorly drained. These soils are both shallow over bedrock. Chenango soils are well drained and are on stream fans. Volusia soils are deep and somewhat poorly drained and are in seepy areas.

Most areas of this association are cleared and used for general farming or are planted in vineyards. The landscape and its proximity to Keuka Lake make the areas climatically ideal for grape production. Control of erosion and drainage of wet or seep spots are necessary in most fields. Many areas of this association have a scenic view overlooking Keuka Lake and are used as residential homesites.

5. *Mardin-Volusia-Lordstown association*

Gently sloping to steep, moderately well drained and somewhat poorly drained, deep soils that have a fragipan and dominantly moderately steep to very steep, well drained, moderately deep soils overlying hard sandstone bedrock; on uplands

This association is on dissected uplands primarily in the central and eastern parts of the county. The plateau summits are intermediate in width.

This association makes up 20.4 percent of the county. It is about 35 percent Mardin soils, 25 percent Volusia soils, 10 percent Lordstown soils, and 30 percent minor soils.

Mardin soils are deep, moderately well drained, and have a fragipan. These soils formed in till and are gently sloping on the plateau summits and moderately steep on the valley sides.

Volusia soils are deep, somewhat poorly drained, and have a fragipan. These soils formed in till on the lower side slopes.

Lordstown soils are moderately deep over sandstone bedrock and are well drained. These soils formed in till. They are gently sloping on hilltops and are steeper on valley sides.

The minor soils in this association are Arnot, Bath, and Chippewa soils. Arnot soils are shallow to bedrock and are well drained and moderately well drained. Bath soils are deep and well drained and have a fragipan. Chippewa soils are deep and poorly drained and are in depressions.

Most of the soils except those on the steeper side slopes have been cleared of trees and have been farmed. Presently, much of the area is idle or is used for general farming, and some areas are used for potato production. Seasonal wetness, slow permeability, and in places slope and shallow depth to bedrock are the major soil features that affect uses.

6. *Oquaga-Morris-Wellsboro association*

Gently sloping to moderately steep, well drained, moderately deep soils overlying hard sandstone bedrock and somewhat poorly drained and moderately well drained, dominantly deep soils that have a fragipan; on uplands

This association is on plateau areas where the underlying glacial till is derived mainly from red sandstone and shale. These areas are in the extreme southwest corner of the county.

This association makes up 3.8 percent of the county. It is about 35 percent Oquaga soils, 30 percent Morris soils, 20 percent Wellsboro soils, and 15 percent minor soils.

Oquaga soils are moderately deep over bedrock and are well drained. These soils formed in till and are gently sloping to moderately steep on hillsides.

Morris soils are deep, somewhat poorly drained, and have a fragipan. These soils are gently sloping or sloping on lower positions in the landscape.

Wellsboro soils are deep, moderately well drained, and have a fragipan. These soils are gently sloping to moderately steep.

The minor soils in this association are Chippewa and Lackawanna soils. Chippewa soils are deep and poorly drained and are in depressions. Lackawanna soils are deep, well drained, and have a fragipan.

About two-thirds of this association has been cleared and farmed, but now many areas are idle and are reverting to brush. Many areas of the dominant soils are extremely stony. The stoniness and remoteness to population centers has caused a decline in farming.

Seasonal wetness, slow permeability, and the presence of rock and stones affect most uses of the soils.

7. *Volusia-Mardin association*

Gently sloping to moderately steep, somewhat poorly drained and moderately well drained, deep soils that have a fragipan; on uplands

This association is on the moderately dissected, smoothly sloping areas of the plateau in the central and southern parts of the county. Generally, the soils are gently sloping or undulating on the hill crests. They are steeper along the hillsides adjacent to widely spaced tributary valleys. In the southern part of the county this association consists of fairly wide, gently sloping saddles that are separated by sloping or moderately steep domelike landforms.

This association makes up about 24 percent of the county. It is about 45 percent Volusia soils, 25 percent Mardin soils, and 30 percent minor soils.

Volusia soils are deep and somewhat poorly drained. These soils have a very dense fragipan that restricts the downward movement of water. They formed in till and are gently sloping or sloping on smooth hillsides. They usually receive some runoff from adjacent soils.

Mardin soils are deep and moderately well drained. These soils also have a very dense fragipan that restricts the downward movement of water. They formed in till and are gently sloping to moderately steep on hillsides. Slopes are distinctly convex and readily shed runoff to adjacent soils.

The minor soils in this association are Chippewa, Fremont, Lordstown, and Tuller soils. Chippewa soils are poorly drained and are in upland depressions that are ponded from runoff. Fremont soils are somewhat poorly drained; they formed in till on uplands. Lordstown soils are well drained, and Tuller soils are somewhat poorly drained; these soils are underlain by sandstone bedrock.

Most areas of this association were cleared of trees and were used for general farming. Those areas still being farmed are used to grow crops for dairy operations. More and more land is being left idle because of seasonal wetness and the seepy conditions of the area. Wetness also affects many nonfarm uses.

Deep Soils, Most of Which Do Not Have a Fragipan, That Formed in Glacial Till and Glacial Outwash

The soils in the three associations of this group are on uplands, terraces, and valley sides. They cover 15.3 percent of the county. These soils are dominantly deep, somewhat excessively drained to somewhat poorly drained, and nearly level to moderately steep.

8. *Fremont-Mardin association*

Nearly level to moderately steep, somewhat poorly drained, deep soils and moderately well drained, deep soils that have a fragipan; on uplands

This association is in the smoothly sloping areas of the plateau in the northwestern part of the county. Generally, the soils are nearly level or gently sloping on broad areas of the hill crests. They are steeper along the side slopes adjacent to the streams that drain areas of the association.

This association makes up 3.7 percent of the county. It is about 40 percent Fremont soils, 20 percent Mardin soils, and 40 percent minor soils.

Fremont soils are deep and somewhat poorly drained. These soils formed in till and are nearly level or gently sloping on uplands. They contain fewer stone fragments than other plateau soils.

Mardin soils are deep, moderately well drained, and have a fragipan. These soils formed in till and are gently sloping to moderately steep on hills near the shoulders of the plateau.

The minor soils in this association are Bath, Chippewa, Lordstown, and Volusia soils. Bath and Lordstown soils are well drained and are on convex landscapes commonly near plateau side slopes. Chippewa soils are poorly drained and are in depressions. Volusia soils are somewhat poorly drained and are in seepy areas on upland saddles or toe slopes.

A large part of the association has been cleared of trees and is used for general farming. Most areas are still used for dairy farming, but some are used for potato production. Sizable areas were planted to coniferous trees. More and more land is being used for recreation. Regionally, broad areas of the hill crests are seasonally wet. Large fields that are on gentle slopes and that have few stone fragments are in this association.

9. *Hornell-Fremont-Mardin association*

Gently sloping to moderately steep, somewhat poorly drained, moderately deep and deep soils and moderately well drained, deep soils that have a fragipan; on uplands

This association is on the gently sloping to moderately steep uplands on the higher elevations in the west-central part of the county. Bedrock controls the relief; it is dominantly soft shale interspersed with lesser amounts of sandstone and siltstone. Soils high in clay content make up a large part of the association.

This association makes up 9.5 percent of the county. It is about 25 percent Hornell soils, 25 percent Fremont soils, 20 percent Mardin soils, and 30 percent minor soils.

Hornell soils are moderately deep over soft shale bedrock and are somewhat poorly drained. These soils are high in clay content. They formed in till and are gently sloping or sloping on uplands.

Fremont soils are deep and somewhat poorly drained. These soils formed in silty glacial till uplands.

Hornell and Fremont soils are side by side in the area. These two soils are on the higher hill crests throughout the association.

Mardin soils are deep, moderately well drained, and have a fragipan. These soils are sloping or moderately steep and formed in till next to drainageways.

The minor soils in this association are Kanona, Lordstown and Volusia soils. Kanona soils are similar to Hornell soils but are deeper to rock. Generally, they are on lower side slopes adjacent to Hornell soils. Volu-

sia soils are somewhat poorly drained and are in seepy areas on lower side slopes. Lordstown soils are moderately deep over bedrock and are near the outer edges of this association.

Some general farming is being done at present, but extensive areas of this association are idle. Slopes are generally favorable for the use of farm equipment. The soils are slow to dry out in spring, and they are sticky when wet. Seasonal wetness and very slow permeability are limitations to most uses.

10. Madrid-Howard-Mardin association

Gently sloping to moderately steep, well drained to somewhat excessively drained, deep soils and moderately well drained soils that have a fragipan; on uplands and valley sides

This association is mainly on undulating to hilly valley sides and smooth slopes on uplands along upper valley walls.

This association makes up 2.1 percent of the county. It is about 25 percent Madrid soils, 25 percent Howard soils, 20 percent Mardin soils, and 30 percent minor soils.

Madrid soils are deep and well drained. These soils formed in glacial till on undulating to hilly uplands.

Howard soils are deep, well drained and somewhat excessively drained. These soils formed in glacial outwash on undulating to hilly valley sides. Madrid and Howard soils are in a complex pattern on rolling or hummocky areas. Howard soils contain more gravel than Madrid soils.

Mardin soils are deep, moderately well drained, and have a fragipan. These soils are gently sloping or sloping. They formed in glacial till on smooth landscapes adjacent to hummocky areas.

The minor soils in this association are Bath, Canaseraga, Lordstown, and Volusia soils. Bath and Canaseraga soils are deep and have a fragipan. Bath soils are well drained and Canaseraga soils are well drained and moderately well drained. Lordstown soils are moderately deep over bedrock and are well drained. Volusia soils are deep and somewhat poorly drained; they are on concave side slopes.

Much of this association has been cleared and farmed. The major soils are well suited to farming, but the more rolling and hilly relief in places limits farming.

Some areas of this association are sources of sand and gravel. Many areas that are well drained are generally favorable for homesites and have few limitations for onsite sewage disposal. Frost pockets are common and crops are subject to damage by frost late in summer and early in fall.

Deep Soils That Formed in Glacial Outwash Deposits and Recent Alluvium

Only one association is in this group. It is in valleys and on terraces, fans, and flood plains. It covers 8.1 percent of the county. The soils are deep, somewhat excessively drained to somewhat poorly drained, and nearly level and gently sloping.

11. Howard-Chenango-Middlebury association

Nearly level and gently sloping, well drained and somewhat excessively drained, deep soils that formed in outwash in valleys and nearly level, moderately well drained and somewhat poorly drained, deep soils that formed in recent alluvium on flood plains.

This association is along the major valleys. The soils in this association are nearly level to gently sloping or undulating on the glacial outwash terraces and fans. They are nearly level on flood plains (fig. 3).

This association makes up 8.1 percent of the county. It is about 40 percent Howard soils, 25 percent Chenango soils, 5 percent Middlebury soils, and 30 percent minor soils.

Howard soils are deep and well drained or somewhat excessively drained. These soils formed in gravelly outwash on nearly level or undulating terraces.

Chenango soils are deep and well drained. These soils are on gently sloping fans that formed where tributary streams enter the main valley.

Middlebury soils are deep and moderately well drained and somewhat poorly drained. These soils formed in alluvial sediments on nearly level flood plains adjacent to the larger streams and rivers.

The minor soils in this association are Red Hook, Tioga, Unadilla, and Wayland soils. Red Hook soils are deep and somewhat poorly drained; they are on outwash terraces. Tioga soils are well drained and Wayland soils are very poorly drained and poorly drained. These soils are on flood plains. Unadilla soils are deep and well drained and are on stream terraces that occasionally flood.

Much of this association is used for farming or urban development. The larger communities are either entirely or mostly in this association. The major soils are among the better soils in the county for farming; the drier soils are generally well suited to urban development.

Seasonal wetness and the hazard of flooding are limitations of the major soils to both farm and nonfarm uses. During catastrophic storms some of the soils on outwash terraces and old stream terraces are also subject to flooding. Some of the soils on the higher outwash terraces are a good source of sand and gravel.

Deep Soils That Formed in Glacial-Lake Sediment, Glacial Outwash, and Recent Alluvium

Only one association is in this group. It is on glacial–lake plains, outwash kames and terraces, and flood plains. It covers 1.1 percent of the county. The soils of this association are deep, somewhat excessively drained to very poorly drained, and nearly level to moderately steep.

12. Dunkirk-Howard-Wayland association

Nearly level to moderately steep, somewhat excessively drained to very poorly drained, deep soils; on lake plains, outwash kames and terraces, and flood plains

This association is on strongly dissected glacial lake

deposits, glacial outwash kames and terraces, and flood plains in valleys (fig. 4).

This association makes up 1.1 percent of the county. It is about 20 percent Dunkirk soils, 20 percent Howard soils, 15 percent Wayland soils, and 45 percent minor soils.

Dunkirk soils are deep and well drained. These soils formed in lake sediments on rolling or hilly lake plains.

Howard soils are deep and well drained or somewhat excessively drained. These soils formed in outwash deposits on gently sloping to hilly kames and terraces.

Wayland soils are deep and poorly drained and very poorly drained. These soils formed in alluvial sediments on nearly level flood plains.

The minor soils in this association are Chenango, Collamer, Niagara, Madrid, and Middlebury soils. Chenango soils are well drained and somewhat excessively drained; they are on fans. Collamer soils are moderately well drained, and Niagara soils are somewhat poorly drained; these soils formed in lake-laid sediments on lake plains. Madrid soils are well drained; they formed in glacial till. Middlebury soils are moderately well drained and somewhat poorly drained; they are on flood plains.

Most areas of this association were originally cleared of trees and were farmed, but now only the more favorable slopes have remained in cultivation. Some of the soils are in vineyards and berry crops, and some of the soils in the outwash kames are sources of sand and gravel.

The silty soils in this association are very erodible. Good tilth is difficult to maintain if the soils are cultivated. They are very unstable on steeper slopes and mass land slippage is a hazard. The gravelly soils on the kames are droughty, and they have adverse slopes that affect both farm and nonfarm uses.

Deep Soils That Formed in Organic Deposits

Only one association is in this group. It consists of organic soils on bogs and swampy basins in valleys. It covers 0.2 percent of the county. The soils of this association are deep, very poorly drained, and level.

13. Carlisle-Palms association

Level to depressional, very poorly drained, deep organic soils; in swampy basins in valleys

This association consists of level muck soils in

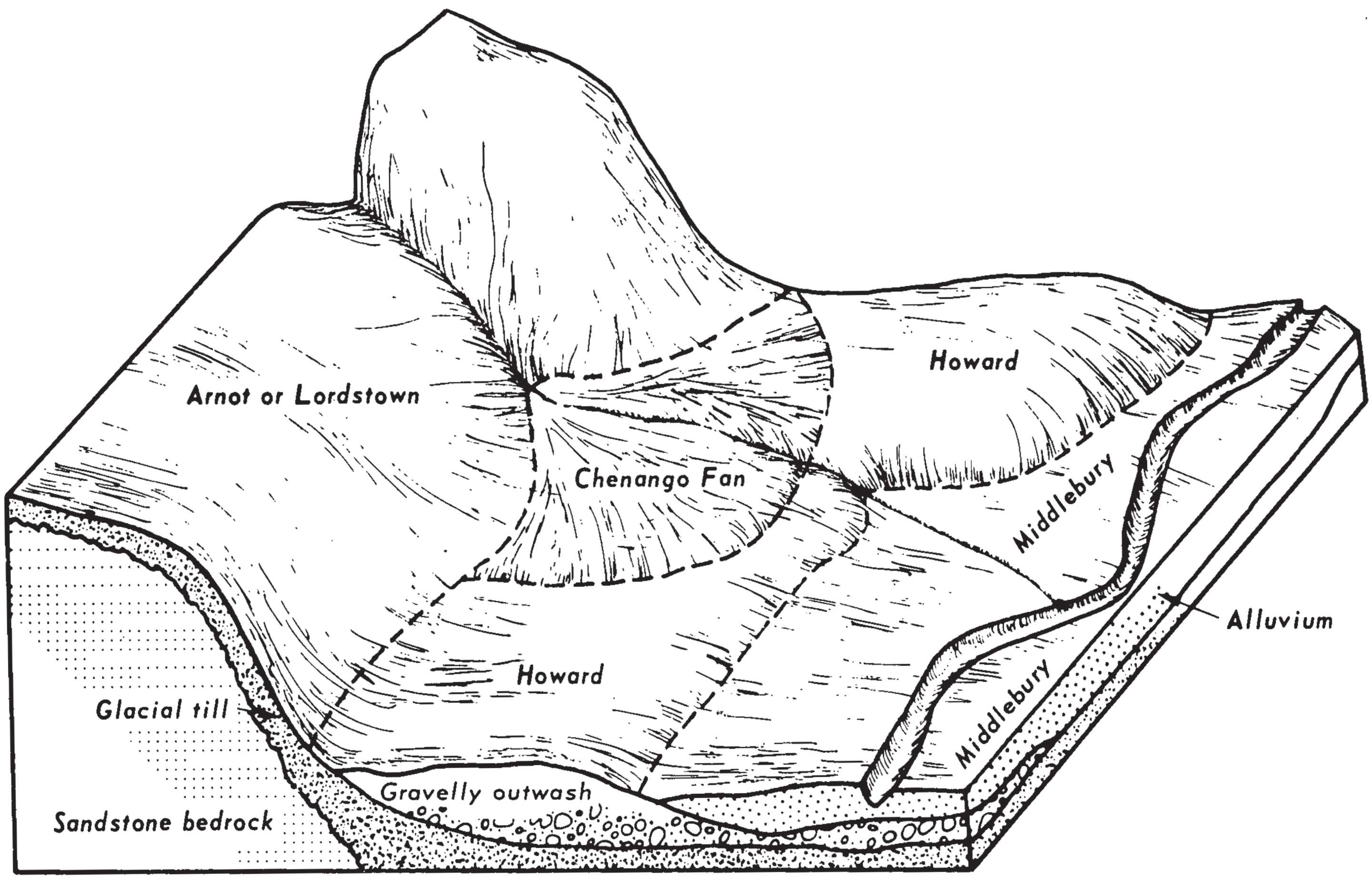

Figure 3.—**Relationship of soils and underlying material in Howard-Chenango-Middlebury association. Arnot or Lordstown soils generally occur on valley sides.**

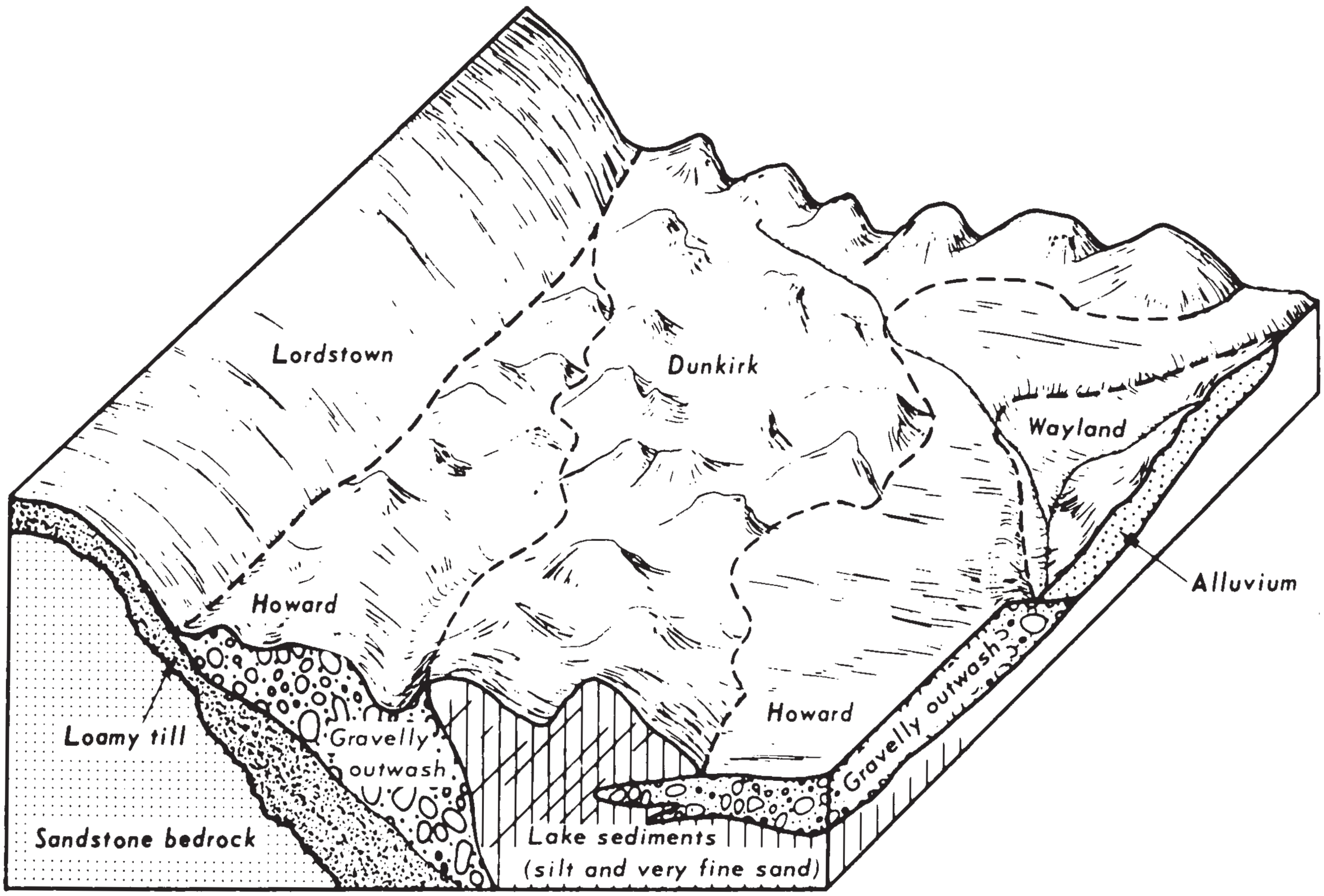

Figure 4.—Relationship of soils and underlying material in Dunkirk-Howard-Wayland association.

swampy depressions. One area of this association is near Arkport, and another area is near Prattsburg.

This association makes up 0.2 percent of the county. It is about 75 percent Carlisle soils, 15 percent Palms soils, and 10 percent minor soils.

Carlisle and Palms soils are very poorly drained. These soils formed in well decomposed to partly decomposed organic matter that accumulated in boggy depressions. In Carlisle soils the organic deposits are more than 51 inches thick over mineral soil layers. They are near the center or the deeper part of the bog. In Palms soils the deposits are 16 to 50 inches thick over mineral layers. They are commonly near the edge of the bog where the organic material is thinner.

The minor soils in this association are Braceville and Wayland soils. Braceville soils are moderately well drained and are on gravel bars that extend into the bog. Wayland soils are very poorly drained and poorly drained and are near the margins of the bog area.

This association has been cleared and drained. Most areas are used for growing onions and potatoes (fig. 5).

Subsidence and soil blowing are maintenance problems of this association and wetness and compressibility are limitations to both farm and nonfarm uses.

Descriptions of the Soils

This section describes each soil series in detail and then, briefly, each mapping unit in that series. Unless stated otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface down to rock or other underlying material. The profile of each series is described twice. The first description is brief and in terms familiar to a layman. The second is more detailed and is for those who need to make thorough and precise studies of soils. The profile described is representative of mapping units in a series. If the profile of a given mapping unit is different from the one described for the series, the differences are apparent in the name of the mapping unit, or the differences are stated in describing the mapping unit. Color terms are for moist soil unless otherwise stated.

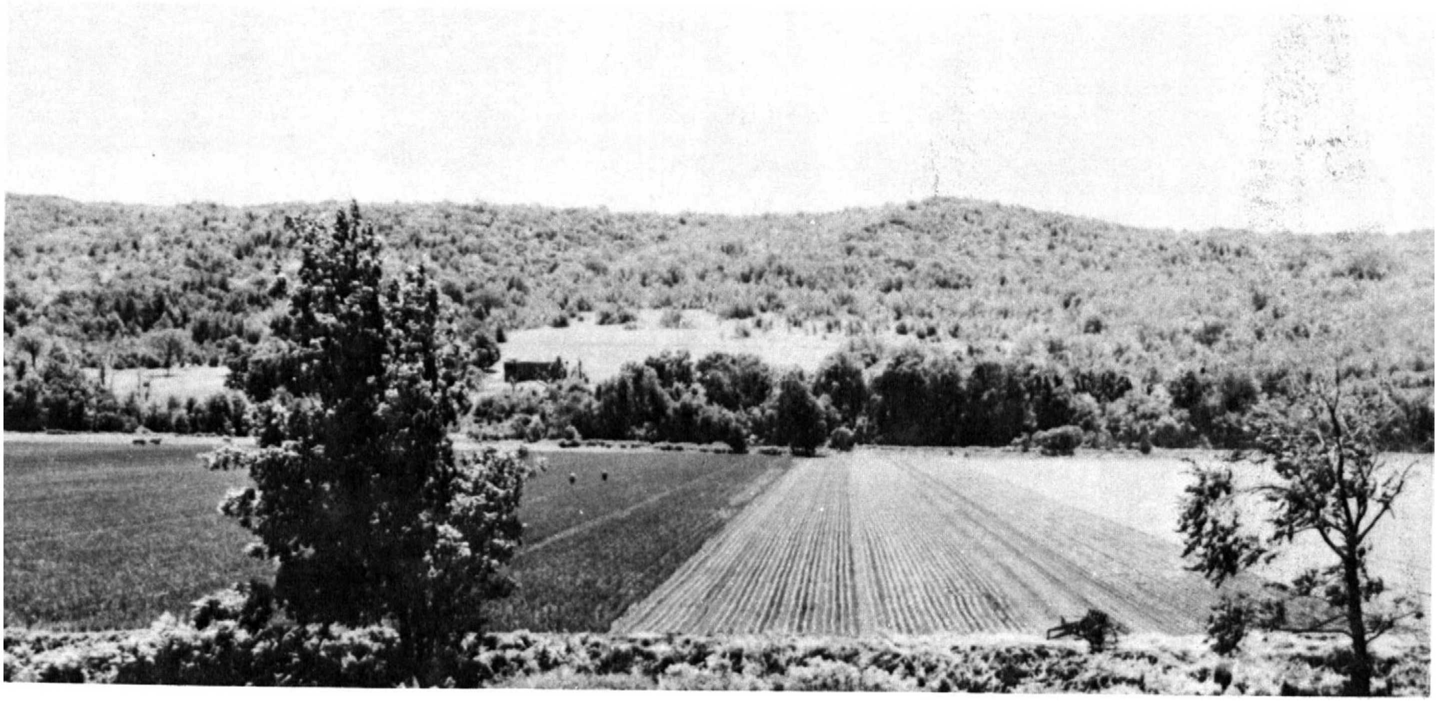

Figure 5.—The soils in the fields are in the Carlisle-Palms association. These soils are organic and are cleared and drained to grow vegetable crops.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Fluvaquents and Ochrepts, for example, do not belong to a soil series. Nevertheless, this mapping unit is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and woodland suitability group in which the mapping unit has been placed. The page where each capability unit, range site, woodland group, or other interpretative group is described is listed in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*7*).[1]

Alden Series

The Alden series consists of deep, very poorly drained soils that formed in glacial till. These soils generally are in saucer-shaped, nearly level depressions in the uplands and along the headwaters of low gradient streams.

In a representative profile the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is friable mottled gray light silty clay loam about 17 inches thick. The underlying material to a depth of 60 inches is firm mottled gray shaly silty clay loam.

The available water capacity is moderate to high. Permeability is moderately slow. The water table remains at or near the surface until early in summer. In dry periods in midsummer, the water table recedes to a depth of more than 30 inches, but it rises after each prolonged rain. The water table affects the root zone, which, unless the soils are drained, extends in most places to a depth of 10 to 15 inches.

Representative profile of Alden silt loam, in a cultivated field in the town of Pulteney, 1 mile east of Prattsburg-Pulteney town line on Brockman Hill Road:

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; moderate medium granular structure; very friable; many roots; 3 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21g—8 to 12 inches; gray (10YR 5/1) light silty clay loam; few fine faint brown (10YR 5/3) mottles along root channels; moderate fine subangular blocky structure; friable; few roots; few fine pores; 5 percent coarse fragments; slightly acid; clear wavy boundary.

B22g—12 to 25 inches; gray (10YR 5/1) light silty clay loam; common medium distinct yellowish brown (10YR 5/4) and brown to dark brown (10YR 4/3) mottles; massive; friable; few fine pores with clay linings; 5 percent coarse fragments; neutral; gradual wavy boundary.

IICg—25 to 60 inches; gray (N 5/0) shaly light silty clay loam; few fine distinct brown (10YR 5/3) mottles; massive; firm; few fine pores; 20 percent coarse fragments; neutral.

Depth to bedrock is more than 60 inches. The solum is 24 to 36 inches thick. Coarse fragments make up as much as 10 percent of the solum and 15 to 25 percent of the C

[1] Italic numbers in parentheses refer to Literature Cited, p. 117.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
Aa	Alden silt loam	3,595	0.4
AlA	Alton gravelly fine sandy loam, 0 to 3 percent slopes	5,315	.6
AlB	Alton gravelly fine sandy loam, undulating	5,250	.5
ARC	Arnot channery silt loam, 2 to 20 percent slopes	30,385	3.4
At	Atherton silt loam	845	.1
BaB	Bath channery silt loam, 3 to 12 percent slopes	9,215	1.0
BaD	Bath channery silt loam, 12 to 20 percent slopes	7,520	.8
BaC	Bath channery silt loam, 20 to 30 percent slopes	5,820	.6
BBE	Bath soils, steep	11,615	1.3
BrA	Braceville gravelly silt loam, 0 to 3 percent slopes	2,880	.3
BrB	Braceville gravelly silt loam, 3 to 8 percent slopes	160	(1)
Ca	Canandaigua silt loam	680	.1
CbB	Canaseraga silt loam, 2 to 6 percent slopes	890	.1
CbC	Canaseraga silt loam, 6 to 12 percent slopes	665	.1
Cc	Carlisle muck	2,400	.2
Ch	Chenango channery silt loam, fan	17,065	1.9
Ck	Chippewa channery silt loam	5,890	.8
CoC	Collamer silt loam, rolling	595	.1
DuC	Dunkirk silt loam, rolling	845	.1
DuD	Dunkirk silt loam, hilly	250	(1)
Ed	Edwards muck	715	.1
FL	Fluvaquents and Ochrepts	25,085	2.8
FrB	Fremont silt loam, 2 to 8 percent slopes	17,055	1.9
HfB	Hornell-Fremont silt loams, 1 to 6 percent slopes	6,655	.7
HfC	Hornell-Fremont silt loams, 6 to 12 percent slopes	14,965	1.7
HgD	Hornell and Fremont silt loams, 12 to 20 percent slopes	11,315	1.3
HHE	Hornell and Fremont silt loams, steep	15,515	1.7
HkD3	Hornell and Fremont silty clay loams, 6 to 20 percent slopes, severely eroded	755	.1
HoA	Howard gravelly loam, 0 to 3 percent slopes	3,645	.4
HoB	Howard gravelly loam, undulating	12,190	1.4
HoC	Howard gravelly loam, rolling	5,000	.6
HpD	Howard-Dunkirk complex, hilly	2,855	.3
HrB	Howard-Madrid complex, undulating	11,230	1.2
HrC	Howard-Madrid complex, rolling	13,250	1.5
HrD	Howard-Madrid complex, 20 to 30 percent slopes	10,000	1.1
HtD	Howard and Alton gravelly soils, 20 to 30 percent slopes	3,625	.4
HtE	Howard and Alton gravelly soils, 30 to 45 percent slopes	3,485	.4
KaA	Kanona silty clay loam, 0 to 2 percent slopes	330	(1)
KaB	Kanona silty clay loam, 2 to 6 percent slopes	2,610	.3
KaD	Kanona silty clay loam, 6 to 20 percent slopes	9,150	1.0
LaB	Lackawanna channery silt loam, 3 to 12 percent slopes	1,265	.1
LaC	Lackawanna channery silt loam, 12 to 20 percent slopes	710	.1
LC	Lackawanna-Wellsboro association, extremely stony	2,895	.3
LoB	Lordstown channery silt loam, 3 to 12 percent slopes	18,640	2.1
LoC	Lordstown channery silt loam, 12 to 20 percent slopes	27,210	3.0
LRE	Lordstown-Arnot association, steep	39,300	4.4
LRF	Lordstown-Arnot association, very steep	67,785	7.5
MaB	Madrid fine sandy loam, undulating	1.310	.1
MaC	Madrid fine sandy loam, rolling	310	(1)
MdB	Mardin channery silt loam, 2 to 8 percent slopes	50,010	5.6
MdC	Mardin channery silt loam, 8 to 15 percent slopes	85,980	9.6
MdD	Mardin channery silt loam, 15 to 25 percent slopes	44,795	5.0
MdD3	Mardin channery silt loam, 8 to 25 percent slopes, severely eroded	1,905	.2
MhC3	Mardin-Ovid complex, 3 to 15 percent slopes, severely eroded	1,120	.1
MnB	Mardin and Volusia channery silt loams, silty substratum, 2 to 6 percent slopes	485	.1
MnC	Mardin and Volusia channery silt loams, silty substratum, 6 to 12 percent slopes	4,660	.5
Mp	Middlebury silt loam	5,750	.6
MrB	Morris channery silt loam, 2 to 8 percent slopes	3,075	.3
MrC	Morris channery silt loam, 8 to 15 percent slopes	2,845	.3
MSB	Morris extremely stony soils, gently sloping	4,625	.5
NgB	Niagara silt loam, 2 to 6 percent slopes	555	.1
OC	Ochrepts and Orthents	9,360	1.0
OgB	Oquaga channery silt loam, 3 to 12 percent slopes	5,805	.6
OgC	Oquaga channery silt loam, 12 to 20 percent slopes	3,655	.4
OgD	Oquaga channery silt loam, 20 to 30 percent slopes	2,440	.3
OvB	Ovid silt loam, 2 to 6 percent slopes	625	.1
OvC	Ovid silt loam, 6 to 12 percent slopes	870	.1
Pa	Palms muck	1,350	.1
Rh	Red Hook silt loam	2,250	.2
Sc	Scio silt loam	1,480	.2
Tg	Tioga silt loam	6,990	.8
TuB	Tuller, channery silt loam, 0 to 6 percent slopes	3,470	.4
TuC	Tuller channery silt loam, 6 to 12 percent slopes	655	.1
Un	Unadilla silt loam	2,715	.3
VoB	Volusia channery silt loam, 3 to 8 percent slopes	66,625	7.4
VoC	Volusia channery silt loam, 8 to 15 percent slopes	105,260	11.7
VoD	Volusia channery silt loam, 15 to 25 percent slopes	17,355	1.9
Wa	Wallington silt loam	1,160	.1
We	Warners silt loam	195	(1)
Wn	Wayland silt loam	10,755	1.2
WoB	Wellboro channery silt loam, 2 to 8 percent slopes	3,770	.4
WoC	Wellsboro channery silt loam, 8 to 15 percent slopes	3,100	.3
WoD	Wellsboro channery silt loam, 15 to 25 percent slopes	845	.1
	Cut and fill land	735	.1
	Gravel pits	600	.1
	Water	2,515	.3
	Total	901,120	100.0

[1] Less than 0.1 percent.

horizon. In undisturbed areas O1 or O2 horizons are 2 to 6 inches thick over an A1 horizon.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from slightly acid to neutral.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 0 to 2. It ranges from silt loam to light silty clay loam and is slightly acid or neutral.

The Cg horizon is similar to the B horizon in color. It ranges from channery or shaly silty clay loam to loam. The C horizon is neutral to moderately alkaline and is calcareous in places in the lower part.

Alden soils are in a drainage sequence with well drained Bath soils, moderately well drained Mardin soils, somewhat poorly drained Volusia soils, and poorly drained Chippewa soils. Alden soils are wetter and lack the fragipan of these soils.

Aa—Alden silt loam. This is a nearly level soil in saucer shaped depressions and long narrow areas along drainageways on uplands throughout the county. The areas are commonly round or elongated and are generally 1 to 10 acres in size.

Included with this soil in mapping were small areas of somewhat poorly drained Volusia soils and poorly drained Chippewa soils and small areas along drainageways and in depressions that have thin alluvial deposits. Many areas have a stony surface.

This soil is not suited to farming unless it is artificially drained. Some areas can be drained and used for row crops, hay, or pasture, but drainage outlets are generally difficult to locate. Most areas have excellent sites for ponds or for wildlife developments. Wetness and ponding limit the use of this soil. Capability subclass IVw; woodland subclass 5w.

Alton Series

The Alton series consists of deep, well drained and somewhat excessively drained soils that formed in glacial outwash deposits that were dominantly sandstone but contained some limestone. These soils are on nearly level to steep outwash plains, kames, and stream terraces in valley areas.

In a representative profile the surface layer is very dark grayish brown gravelly fine sandy loam about 6 inches thick. The subsoil is very friable very gravelly sandy loam about 30 inches thick; in the upper 12 inches the subsoil is yellowish brown, and in the lower 18 inches it is brown. The underlying material to a depth of 60 inches is loose yellowish brown very gravelly loam.

The available water capacity is low to moderate. Permeability is rapid. The root zone in most places extends to a depth of 30 inches, but it is not restricted to that depth. If the soils are not limed, the surface layer is strongly acid.

Representative profile of Alton gravelly fine sandy loam, undulating, in a cultivated field 1 mile south of village of Savona, on old Savona-Campbell Road:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly fine sandy loam; weak fine granular structure; very friable; many roots; 25 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—6 to 18 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; weak fine subangular blocky structure; very friable; common roots; 40 percent coarse fragments; medium acid; gradual wavy boundary.

B22—18 to 36 inches; brown (10YR 5/3) very gravelly sandy loam; very weak medium subangular blocky structure; very friable; few roots; 40 percent coarse fragments; medium acid; gradual wavy boundary.

IIC—36 to 60 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; single grained; loose; few roots; 60 percent coarse fragments; slightly acid.

Depth to bedrock is more than 5 feet. The solum is 30 to 50 inches thick. Coarse fragments that are mainly gravel but include cobbles and flagstones make up to 35 to 50 percent of the B horizon and 50 to 60 percent of the C horizon. Free carbonates are between depths of 40 and 80 inches.

The Ap horizon has hue of 10YR, value of 3 to 4, and chroma of 2 to 4. It is very strongly acid or strongly acid.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It ranges from sandy loam to loam and from strongly acid to neutral.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It ranges from very gravelly sandy loam to loamy sand, or it is stratified gravel and sand. It is medium acid to neutral in the upper part and increases to mildly alkaline in the lower part.

Alton soils are near well drained Unadilla soils, and moderately well drained Braceville soils. They are more sandy than Howard and Unadilla soils and are better drained than Braceville soils.

AlA—Alton gravelly fine sandy loam, 0 to 3 percent slopes. This nearly level soil is on glacial outwash terraces that are mainly in the major valleys. The areas are generally long and narrow and are 10 acres or more in size.

Included with this soil in mapping were small areas, in depressions, of Braceville soils, which are wetter than this Alton soil, Unadilla soils, on terraces, which are more silty than this Alton soil, and spots of well drained Tioga soils in narrow meandering channels of flood plains.

This soil is suited to most of the crops commonly grown in the county, including hay, pasture, and trees. It is well suited to early vegetable crops grown under irrigation because drainage is favorable. Deep rooted crops are preferred on this soil for general cropping. This soil is a source of sand and gravel and is in parts of most urban communities. It is very favorable to use for urban development.

This soil can be worked early in spring. The use of winter cover crops or crop residue helps protect the soil surface from soil and water loss. Capability subclass IIs; woodland subclass 3o.

AlB—Alton gravelly fine sandy loam, undulating. This undulating soil is mainly in areas of kettle and kame glacial outwash terraces and valley trains. Slopes are short and range from 3 to 12 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas in depressions of Braceville soils, which are slightly wetter than this Alton soil, and spots on fans of Chenango soils, which are more loamy than this Alton soil.

This soil is suited to most cultivated crops, hay, pasture, and trees. It is a source of sand and gravel and is in parts of most urban communities. It is generally a favorable soil to use for urban developments.

This soil tends to be droughty. Complex slopes are common and they restrict contouring. The no plow

system is well suited to these slopes. The hazard of erosion is moderate if the soil is cultivated and not protected. Winter cover crops and the use of crop residues help reduce soil and water loss. Capability subclass IIs; woodland subclass 3o.

Arnot Series

The Arnot series consists of shallow, well drained and moderately well drained soils that formed in a thin mantle of glacial till. These soils are on convex, nearly level to very steep uplands.

In a representative profile the surface layer is dark grayish brown channery silt loam about 7 inches thick. The subsoil is friable yellowish brown very channery silt loam about 10 inches thick and is faintly mottled in the lower part. Underlying the subsoil at a depth of 17 inches is sandstone bedrock (fig. 6).

The available water capacity is low. Permeability is moderate. In wet periods water is perched above the bedrock in places. The bedrock is commonly shattered and highly jointed, permitting rapid infiltration of free water. The root zone extends to a depth of 10 to 20 inches above the bedrock. If the soils are not limed, the surface layer is strongly acid.

Representative profile of Arnot channery silt loam, 2 to 20 percent slopes, in a cultivated field in the town of Hornby, approximately ½ mile south of hamlet of Hornby, and 1,500 feet east of County Route 41:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate fine granular structure; very friable; many roots; 30 percent coarse fragments; strongly acid; clear smooth boundary.

B21—7 to 15 inches; yellowish brown (10YR 5/4) very channery silt loam; weak fine subangular blocky structure; friable; many roots; few fine pores; 40 percent coarse fragments; medium acid; clear smooth boundary.

Figure 6.—**Arnot soils are underlain by sandstone bedrock that fractures into flat fragments.**

B22—15 to 17 inches; yellowish brown (10YR 5/4) very channery silt loam; common medium faint brown (10YR 5/3) mottles; weak thin platy structure; friable; few roots; many fine pores; 60 percent coarse fragments; strongly acid; abrupt smooth boundary.

R—17 inches; olive gray (5Y 4/2) fine grained sandstone bedrock.

Depth to bedrock ranges from 10 to 20 inches. The solum is 10 to 20 inches thick. It is medium acid to very strongly acid. Coarse fragments that are dominantly thin and flat make up 35 to 50 percent of the solum.

The Ap horizon has hue of 5YR to 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 5YR to 2.5Y, value of 4 or 5, and chroma of 3 to 6. The horizon above the bedrock is silt loam or loam that is mottled in many profiles. Reaction is medium acid or strongly acid. A few profiles have a thin C horizon of rock fragments and silt loam. The bedrock ranges from massive sandstone to interbedded sandstone, siltstone, and shale. It is reddish, olive, or gray.

Arnot soils are near Lordstown and Tuller soils. Arnot soils are shallower to bedrock than Lordstown soils and are drier than Tuller soils.

ARC—Arnot channery silt loam, 2 to 20 percent slopes. This nearly level to moderately steep soil is on the sides of the long narrow ridges in the uplands. The areas range from a few acres to more than 100 acres in size. This soil has a profile similar to the one described as representative of the series, but in the southwestern corner of the county the soils are redder.

Included with this soil in mapping were areas of moderately deep, well drained Lordstown and Oquaga soils in steeper areas and somewhat poorly drained and poorly drained Tuller soils and somewhat poorly drained Hornell soils in flatter areas. Also included were rock outcrops and small areas of moderately well drained Mardin soils and, in the southern part of the county, small areas of redder, well drained Lackawanna soils and redder, moderately well drained Wellsboro soils.

This soil is droughty because it is shallow to bedrock. It is generally better suited to early maturing grain crops that can tolerate droughtiness. This soil can be used for cultivated crops, hay, pasture, and trees.

Slopes of more than 15 percent are difficult and hazardous to work and are better left in sod or trees. Renovating and working the soil across the slope to protect it from soil and water loss are important in reseeding forage crops. Maintaining surface mulches and working across the slope are suitable practices in row cropping and in renovating the soil. Capability subclass IVe; woodland subclass 4d.

Atherton Series

The Atherton series consists of deep, poorly drained and very poorly drained soils that formed in glacial outwash deposits that were dominated by sandstone and a little limestone. These soils are nearly level and are in depressional areas on glacial outwash terraces and older stream terraces.

In a representative profile the surface layer is very dark gray silt loam about 9 inches thick. The subsoil is about 29 inches thick; in the upper 13 inches

it is friable mottled gray silt loam, and in the lower 16 inches it is friable mottled dark yellowish brown gravelly silt loam. The underlying material from a depth of 38 to 60 inches is friable mottled dark grayish brown gravelly loam.

The available water capacity is moderate to high. Permeability is moderate. The water table is at or near the surface most of the year. The root zone in most places is restricted to a depth of 10 to 15 inches. Nitrogen is plentiful in Atherton soils, but it is released very slowly when the soils are wet and cold. If the soils are not limed, the surface layer is medium acid to slightly acid.

Representative profile of Atherton silt loam, in a hayfield in the town of Bath, 100 feet east of State Route 415 and 25 feet north of Bath-Campbell town line:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam; few medium distinct dark red (2.5YR 3/6) mottles; moderate coarse granular structure; friable; many fine roots; common fine pores; no coarse fragments; medium acid; abrupt smooth boundary.

B21g—9 to 22 inches; gray (5YR 5/1) silt loam; many medium distinct light olive brown (2.5Y 5/4) mottles; massive; friable; few fine roots in upper 6 inches; few fine pores; 5 percent coarse fragments; medium acid; clear wavy boundary.

IIB22g—22 to 38 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; many medium and coarse distinct gray (10YR 5/1) mottles; massive; friable; no roots; few pores; 25 percent coarse fragments; slightly acid; clear smooth boundary.

IICg—38 to 60 inches; dark grayish brown (10YR 4/2) gravelly loam; common medium distinct gray (10YR 5/1) and common coarse distinct yellowish brown (10YR 5/6) mottles; massive; friable; few pores; 25 percent coarse fragments; slightly acid.

The solum is 20 to 44 inches thick. Coarse fragments make up 1 to 20 percent of the horizons above a depth of 20 inches and 5 to 35 percent of the horizons that are at a depth of 20 to 40 inches. Reaction ranges from strongly acid to neutral in the Ap and B horizons and from medium acid to mildly alkaline in the IIB and IIC horizons.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B horizon has hue of 5Y to 10YR, value of 4 or 5, and chroma of 1 to 4. It is friable or firm, has common or many, distinct or prominent mottles, and ranges from loam to silty clay loam. Coarse fragments make up as much as 30 percent of the horizon.

The C horizon consists of layers of gravel intermingled with layers ranging from sand to silty clay and having some or no gravel.

Atherton soils are in a drainage sequence with well drained and somewhat excessively drained Alton soils, moderately well drained Braceville soils, and somewhat poorly drained Red Hook soils.

At—Atherton silt loam. This nearly level soil is in low areas on outwash terraces throughout the county. The areas are commonly long and narrow and are seldom more than 5 acres in size.

Included with this soil in mapping were small areas of somewhat poorly drained Red Hook soils, somewhat poorly drained Wallington soils, and very poorly drained and poorly drained Wayland soils. Also included because of their small acreage were small areas of poorly drained and very poorly drained sandy soils in the northern part of the county.

This soil is well suited to dugout ponds or marsh developments. In undrained areas it is suited to pasture and provides some grazing, mostly late in summer. This soil is too wet to be used for crops unless it is artificially drained. In the undrained areas it is too wet for those tree species commonly available for planting. Capability subclass IVw; woodland subclass 4w.

Bath Series

The Bath series consists of deep, well drained soils that formed in glacial till that was derived mainly from sandstone and siltstone. These soils are gently sloping to steep and are on uplands at higher elevations in the north-central part of the county. They have a very firm, brittle fragipan at a depth of 26 to 36 inches.

In a representative profile the surface layer is pinkish gray channery silt loam about 5 inches thick. The subsoil is about 36 inches thick. In the upper 9 inches it is very friable strong brown channery silt loam; in the 9 inches below that it is friable yellowish brown channery silt loam; in the next 8 inches it is friable light olive brown channery loam; and in the lower 10 inches there is a very firm olive brown channery loam fragipan. The underlying material to a depth of 60 inches is firm grayish brown channery loam. Fractured bedrock is at a depth of 60 inches.

The available water capacity is moderate above the fragipan. The water table is perched above the slowly permeable fragipan for brief periods in the spring. The root zone in most places is restricted to the friable, well aerated surface layer and subsoil above the fragipan. If the soils are not limed, the surface layer is very strongly acid to medium acid.

Crops respond well to applications of lime and fertilizer. Bath soils contain many hard, angular, channery, and flaggy fragments and sandstone that interfere with some tillage and harvesting operations.

Representative profile of Bath channery silt loam, 3 to 12 percent slopes, in a wooded area in the town of Wayland, 3 miles southwest of village of Cohocton on Potter Hill:

O2—1 to 0 inches; black (N 2/0) decomposed organic material; strong medium granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

A2—0 to 5 inches; pinkish gray (7.5YR 6/2) channery silt loam; moderate fine and medium subangular blocky structure; friable; many medium roots; many medium and large pores; 15 percent coarse fragments; strongly acid; clear smooth boundary.

B21—5 to 14 inches; strong brown (7.5YR 5/6) channery silt loam; moderate fine subangular blocky structure; very friable; many medium roots; common medium and few large pores; 15 percent coarse fragments; strongly acid; clear smooth boundary.

B22—14 to 23 inches; yellowish brown (10YR 5/6) channery silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; many medium and large pores; 15 percent coarse fragments; strongly acid; clear wavy boundary.

B23—23 to 31 inches; light olive brown (2.5Y 5/4) channery loam; weak medium subangular blocky structure; friable; few fine roots; common medium and large pores; 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bx—31 to 41 inches; olive brown (2.5Y 4/4) channery loam; weak very coarse prismatic structure; massive

within prisms; very firm; brittle; few roots along prism faces; few medium and large pores with thin clay linings; 35 percent coarse fragments; medium acid; clear wavy boundary.

C—41 to 60 inches; grayish brown (2.5Y 5/2) channery loam; massive; firm; common medium pores; 35 percent coarse fragments; medium acid; abrupt smooth boundary.

R—60 inches; fractured siltstone bedrock.

Depth to bedrock is 5 feet or more. The solum is 40 to 60 inches thick. Depth to the top of the fragipan ranges from 26 to 36 inches. Coarse fragments make up to 15 to 30 percent of the material above the fragipan and 25 to 50 percent of the fragipan and C horizon. Reaction ranges from very strongly acid to medium acid in the horizons above the fragipan, from very strongly acid to slightly acid in the fragipan, and from strongly acid to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 2 or 3.

The B2 horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 6. It is channery loam or channery silt loam.

The Bx and C horizons are similar to the B2 horizon in color, but the texture ranges from channery silt loam to channery sandy loam.

Bath soils are in a drainage sequence with moderately well drained Mardin soils and somewhat poorly drained Volusia soils. Bath soils are deeper to bedrock than moderately deep Lordstown soils.

BaB—Bath channery silt loam, 3 to 12 percent slopes. This gently sloping or undulating soil is on convex side slopes on higher plateau areas of uplands where it receives little or no runoff from adjacent soils. The areas are irregular in shape and variable in size. This soil has a profile similar to the one described as representative of the series, but in many places it has been cultivated and has a very dark grayish brown to brown surface layer 6 to 10 inches thick.

Included with this soil in mapping were small areas of similar but wetter Fremont, Mardin, and Volusia soils that are generally on lower landscapes where some runoff accumulates and delays tillage operations unless these soils are drained. Also included were spots of moderately deep, well drained Lordstown soils.

This soil is suited to cultivated crops, hay, pasture and trees. It is well suited to most crops used in dairy farming and can be used for early-season crops, including potatoes and peas.

Stone fragments are dominantly flat and separate well from potatoes during mechanical harvesting, but they cause excessive wear of farm equipment. The hazard of erosion is slight to moderate if this soil is cultivated and not protected. Contour tillage and stripcropping, diversions to break long slopes, and crops that provide winter cover help control erosion and loss of water. Keeping tillage to a minimum and using crop residue also help control erosion. Capability subclass IIe; woodland subclass 3o.

BaC—Bath channery silt loam, 12 to 20 percent slopes. This sloping and moderately steep soil is in long areas on ridges or sides of ridges that are in higher areas of the plateau where runoff does not accumulate. The areas vary in size.

Included with this soil in mapping were small areas of similar but wetter Mardin soils in lower areas where some runoff accumulates and spots of moderately deep, well drained Lordstown soils.

This soil is suited to cultivated crops, hay, pasture, and trees. It is used mainly for grain and hay crops in support of dairy farming. Some row crops are grown.

The use of large tillage and harvesting equipment is difficult. The hazard of erosion is severe if this soil is cultivated and not protected. Contour tillage and stripcropping and grassed waterways are needed to control erosion and conserve moisture. Keeping tillage to a minimum, growing a cover crop, and using crop residue help maintain soil structure and increase the rate of water intake. If row crops are grown, planting in surface mulch of plant residue, using no-plow tillage, and keeping tillage to a minimum help protect the soil. Capability subclass IIIe; woodland subclass 3r.

BaD—Bath channery silt loam, 20 to 30 percent slopes. This moderately steep soil is on side slopes of hills and ridges in higher areas of the plateau where runoff does not accumulate. The areas are long and narrow and are about 30 to 60 acres in size.

Included with this soil in mapping were small areas of similar but wetter Mardin soils in lower areas where some runoff water accumulates and spots of moderately deep, well drained Lordstown soils and shallow, well drained and moderately well drained Arnot soils.

This soil is suited to hay, pasture, and trees. Large areas are in forest, and others are idle.

The hazard of erosion is very severe if this soil is cultivated and not protected. Slopes make the use of tillage and harvesting equipment difficult and hazardous. Tillage operations should be used mainly to renovate hay crops and pasture sod. If row crops are grown, a cropping system that includes no-plow planting and that maintains crop residue on the surface helps protect these soils. If slope permits, contour tillage or stripcropping can also be used. Capability subclass IVe; woodland subclass 3r.

BBE—Bath soils, steep. These soils are on side slopes of drainage dissections in the plateau. The areas are long and narrow and are about 10 to 70 acres in size. Slopes are mainly between 30 and 45 percent but range to as much as 50 percent. These soils have a profile similar to the one described as representative of the series, but the surface layer is channery silt loam or loam.

Included in mapping were small areas of Lackawanna soils, which are similar to Bath soils but are reddish in color, and spots of moderately deep, well drained Lordstown and Oquaga soils and shallow Arnot soils.

These soils are not suited to cultivated crops because of steepness and the excessive hazard of erosion. In most areas these soils are in trees. In a few cleared, droughty areas they provide some native pasture, and in others they are idle and reverting to brush.

Steep slopes make the use of machinery difficult and hazardous during logging operations. The hazard of erosion is severe. Capability subclass VIe; woodland subclass 3r.

Braceville Series

The Braceville series consists of deep, moderately well drained soils that formed in water-sorted materials from glacial outwash deposits that were dominantly sandstone. These soils are nearly level to gently sloping and are on glacial outwash terraces, fans, and water-sorted moraines throughout the county along the major rivers and streams.

In a representative profile the surface layer is dark brown gravelly silt loam about 8 inches thick. The subsoil is about 28 inches thick. In the upper 10 inches it is dark yellowish brown gravelly loam; in the 6 inches below that it is mottled brown gravelly silt loam; and in the lower 12 inches it has a mottled olive brown firm gravelly silt loam fragipan. The underlying material to a depth of 60 inches is grayish brown stratified sand and gravel.

The available water capacity is low to moderate. Permeability is moderate above the fragipan and moderately slow or slow in the fragipan. In spring and in other wet periods, a temporary high water table is present. In the early growing season the root zone in most places extends to a depth of 24 inches. If the soils are not limed, the surface layer is very strongly acid to medium acid.

Representative profile of Braceville gravelly silt loam, 0 to 3 percent slopes, in a cultivated field in the town of Campbell, about ½ mile north of the village of Campbell:

Ap—0 to 8 inches; dark brown (10YR 3/3) gravelly silt loam; strong fine granular structure; very friable; many roots; 15 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B21—8 to 18 inches; dark yellowish brown (10YR 4/4) gravelly loam; weak medium subangular blocky structure; very friable; many roots; 15 percent coarse fragments; strongly acid; clear wavy boundary.

B22—18 to 24 inches; brown (10YR 5/3) gravelly silt loam; common medium distinct brownish yellow (10YR 6/6) and gray (10YR 5/1) mottles; weak medium subangular blocky structure; friable; few roots; few fine pores; 25 percent coarse fragments; medium acid; clear wavy boundary.

Bx—24 to 36 inches; olive brown (2.5Y 4/4) gravelly silt loam; common medium distinct gray (5Y 5/1) and olive (5Y 5/3) mottles; massive; firm; brittle; common fine pores with clay linings in some pores; 30 percent coarse fragments; medium acid; clear wavy boundary.

IIC—36 to 60 inches; grayish brown (10YR 5/2) stratified sand and gravel; single grained; medium acid.

The solum is 30 to 40 inches thick. It is very strongly acid to medium acid, and the substratum ranges from strongly acid to slightly acid. Depth to the fragipan ranges from 15 to 30 inches. Coarse fragments are present throughout the soil and make up 1 to 30 percent of the horizons above the Bx horizon and 20 to 40 percent of the Bx horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B2 horizons have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. They range from silt loam to gravelly sandy loam and are strongly acid or medium acid. The Bx horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is firm or very firm gravelly silt loam or gravelly loam.

The IIC horizon is stratified sand and gravel and ranges from medium acid to neutral.

Braceville soils are near Alton, Red Hook, and Scio soils. Braceville soils are wetter than Alton soils and better drained than Red Hook soils. Braceville soils have coarse fragments and a fragipan; Scio soils do not have these.

BrA—Braceville gravelly silt loam, 0 to 3 percent slopes. This nearly level soil is in concave areas on gravelly terraces. The areas are generally less than 10 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were a few wetter spots and small areas of somewhat poorly drained Red Hook soils and a moderately well drained soil that has 16 to 39 inches of silt over a gravelly substratum and the level areas of Chenango fans.

This soil is suited to cultivated crops, pasture, and trees. The main limitation is wetness in spring which delays planting in some places and limits the choice of crops. Artificial drainage can be used to overcome wetness. Minimum tillage, cover crops, and sod crops help maintain good tilth. Seasonal wetness and the moderately slowly to slowly permeable fragipan are the major limitations to many nonfarm uses. Capability subclass IIw; woodland subclass 2o.

BrB—Braceville gravelly silt loam, 3 to 8 percent slopes. This gently sloping soil is in areas of the terminal moraine south of Dansville. The areas are generally oblong, concave, and less than 10 acres in size.

Included with this soil in mapping were small areas of well drained Dunkirk and Madrid soils and a deep silty soil that has a profile similar to the one described as representative of the Braceville series but contains no gravel.

This soil is suited to cultivated crops, hay, pasture, and trees. Erosion is a problem on the silty soils. Contour tillage and the use of crop residue allow more intensive use of these soils by conserving moisture and checking soil losses on long slopes. Terraces, diversion ditches, and contour stripcropping also help control erosion and conserve moisture. Seasonal wetness and the moderately slowly to slowly permeable fragipan are the major limitations to many nonfarm uses. Capability subclass IIw; woodland subclass 2o.

Canandaigua Series

The Canandaigua series consists of deep, poorly drained soils that formed in lacustrine deposits of silt, very fine sand, and clay. These soils are in nearly level or slightly depressed areas on lake plains.

In a representative profile the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is mottled gray silt loam about 17 inches thick. The substratum from a depth of 26 to 60 inches is mottled grayish brown silt loam.

The available water capacity is high. Permeability is moderately slow. A high water table is near the surface for long periods. The root zone in undrained areas is restricted mostly to the subsoil, but in drained areas it extends to a depth of 15 to 20 inches. The soils contain very large amounts of nitrogen, but the nitrogen is very slowly available to the plants if the soils are not drained. Prolonged wetness is a major limitation to farm and nonfarm uses.

Representative profile of Canandaigua silt loam, in an idle field in the town of Wheeler, 200 feet west of

Dineharts Crossing Road, 1 mile south of Beans Station:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine subangular blocky structure; friable; many fine roots; 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21g—9 to 17 inches; gray (10YR 5/1) silt loam; many medium distinct yellowish brown (10YR 5/8) and few medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; friable; common fine roots; few fine pores; thin clay films in pores; 1 percent coarse fragments; neutral; gradual wavy boundary.

B22g—17 to 26 inches; gray (10YR 5/1) silt loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure; friable; few fine roots; few fine pores; thin clay films in pores; no coarse fragments; neutral; gradual wavy boundary.

C1—26 to 34 inches; grayish brown (10YR 5/2) silt loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/8) mottles; massive; friable; few fine roots; few fine pores; neutral; gradual wavy boundary.

C2—34 to 60 inches; grayish brown (10YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; varved, moderately alkaline; calcareous.

The solum is 20 to 40 inches thick. Undisturbed areas have a few inches of muck over the mineral soil. Carbonates are at a depth of 24 to 60 inches.

The Ap horizon has hue of 7.5YR to 2.5Y, value of 3, and chroma of 1 or 2. Reaction ranges from medium acid to mildly alkaline.

The B horizons have hue of 10YR, value of 4 through 6, and chroma of 1 or 2. They range from silt loam to light silty clay loam. Reaction ranges from slightly acid to mildly alkaline.

The C horizon is similar to the B horizon in color, but reaction ranges from neutral to moderately alkaline.

Canandaigua soils are near Atherton, Niagara, and Palms soils. They lack the coarse fragments of Atherton soils and are wetter than Niagara soils. Canandaigua soils formed in mineral materials and Palms soils formed in organic deposits.

Ca—Canandaigua silt loam. This soil is in nearly level or slightly depressed areas where water-sorted sediments have accumulated. The areas are commonly round or elongated and are 10 to 100 acres in size.

Included with this soil in mapping were small areas of Wallington soils and, near Hammondsport, a small area of a poorly drained soil that has clay throughout the profile. Also included was an area of a poorly drained, acid, medium textured soil that formed in alluvial sediments along streams.

If this soil is adequately drained it is suited to the crops commonly grown in the county, otherwise it is not suited to cultivated crops. A few areas provide some pasture during dry periods in summer and early in fall. Special care is on the soil if tile drainage is installed to prevent plugging with silt and fine sand. Wetness limits the soil for many nonfarm uses. Capability subclass IIIw; woodland subclass 4w.

Canaseraga Series

The Canaseraga series consists of deep, moderately well drained to well drained soils that formed in silty material underlain by firm glacial till. These soils are gently sloping or sloping on uplands and lower slopes of large valleys.

In a representative profile the surface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is about 58 inches thick. In the upper 16 inches it is yellowish brown and light yellowish brown friable silt loam; in the 8 inches below that it is mottled yellowish brown firm silt loam; and in the lower 34 inches it is a brown, very firm, channery silt loam fragipan.

The available water capacity is moderate. Permeability is moderate above the fragipan. The root zone in most places is restricted to a depth of 20 to 36 inches. In spring and in other wet periods, a water table is perched above the slowly permeable fragipan. Seasonal wetness and the dense, slowly permeable fragipan are limitations to farm and nonfarm uses.

Representative profile of Canaseraga silt loam, 2 to 6 percent slopes, in a forested area in the town of Wayland, adjacent to County Route 90, ½ mile west of hamlet of Patchinville:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; many roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

B21—4 to 12 inches; yellowish brown (10YR 5/6) silt loam; weak fine granular structure; friable; common roots; 5 percent coarse fragments; strongly acid; clear smooth boundary.

B22—12 to 20 inches; light yellowish brown (10YR 6/4) silt loam; weak fine subangular blocky structure; friable; few roots; 5 percent coarse fragments; strongly acid; clear smooth boundary.

B23—20 to 28 inches; yellowish brown (10YR 5/4) silt loam; weak medium platy structure or massive; firm; few fine faint light brownish gray (10YR 6/2) mottles; 5 percent coarse fragments; medium acid; gradual wavy boundary.

IIBx—28 to 62 inches; brown (10YR 5/3) channery silt loam; moderate very coarse prisms, massive within prisms; very firm; 25 percent coarse fragments; medium acid.

Depth to bedrock is generally more than 5 feet. The solum is 40 to more than 60 inches thick. The silty mantle is 20 to 36 inches thick. Reaction ranges from very strongly acid to medium acid in horizons above the fragipan and from strongly acid to mildly alkaline in the fragipan and C horizon.

The A1 or Ap horizon has hue of 10YR, value of 3 through 5, and chroma of 2.

The B2 horizons have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 through 6. It is very fine sandy loam or silt loam. Some places have an A'2 horizon above the fragipan. It has hue of 10YR, value of 5, and chroma of 2 or 3.

The Bx horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The fine earth fraction is loam or silt loam. Coarse fragments make up 20 to 40 percent of the Bx horizon and the underlying C horizon.

The C horizon if present is similar to the Bx horizon in color, but it ranges from gravelly loam to silt loam.

Canaseraga soils are near Bath and Madrid soils. They have a thicker silty mantle than either Bath or Madrid soils.

CbB—Canaseraga silt loam, 2 to 6 percent slopes. This gently sloping soil is on lower valley sides and convex knolls in areas of major terminal moraines. The areas on the valley sides are oblong and parallel with the valley, and those areas on the knolls are round.

Included with the soil in mapping were small areas of somewhat poorly drained Volusia soils, well drained Howard-Madrid complex, well drained and moderately

well drained Mardin soils, and, near Presho, areas where the fragipan and underlying material contained more sand.

This soil is suited to cultivated crops, hay, pasture, and trees. It is generally free of stones in the plow layer and is easily cultivated.

The hazard of erosion is moderate if this soil is cultivated and not protected. Wetness is a problem early in spring, and careful management is needed to help reduce crusting, erosion, and compaction. Good soil structure is difficult to maintain. The soil should not be plowed or cultivated when wet. Keeping tillage to a minimum, using an occasional sod crop in the cropping system, returning crop residue to the soil, and providing a cover in winter also help maintain tilth and control erosion. Seasonal wetness and a slowly permeable fragipan are limitations to many nonfarm uses. Capability subclass IIe; woodland subclass 2o.

CbC—Canaseraga silt loam, 6 to 12 percent slopes. This sloping soil is in areas of smoothly sloping hillsides and convex knolls. Most areas are less than 10 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of somewhat poorly drained Volusia soils, well drained Howard-Madrid complex, well drained and moderately well drained Mardin soils, and, in the vicinity of Presho, areas where the fragipan and underlying material contained more sand.

This soil is suited to cultivated crops, hay, pasture, and trees.

The hazard of erosion is severe if the soil is cultivated and not protected. Conservation practices are needed where row crops are grown. Diversion terraces, contour stripcropping, returning crop residues to the soil, and growing cover crops and sod crops help control erosion. Seasonal wetness, a slowly permeable fragipan, and slope are limitations to many nonfarm uses. Capability subclass IIIe; woodland subclass 2r.

Carlisle Series

The Carlisle series consists of deep, very poorly drained muck soils that formed in more than 51 inches of woody organic deposits. These soils are in bogs in low places that formerly were lakes or ponds.

In a representative profile the surface layer is very dark brown muck about 13 inches thick. It is underlain by mucky material that extends to a depth of about 70 inches. In the upper 23 inches this material is very dark brown; in the 27 inches below that it is very dark grayish brown; and in the lower 9 inches it is dark brown. The underlying material to a depth of 162 inches is light brownish gray marl.

The available water capacity is high. Permeability is rapid and very rapid. The water table remains at or near the surface and affects the root zone unless the soil is artificially drained. If the soil is drained, the root zone extends to a depth of about 36 inches. Wetness and lack of drainage outlets are the main limitations to farm and nonfarm uses.

Representative profile of Carlisle muck, in a swampy area about ½ mile west of the hamlet of Atlanta in the town of Cohocton:

Oa1—0 to 13 inches; very dark brown (10YR 2/2) broken face; pressed and rubbed sapric material; 20 percent fiber, none rubbed; weak very fine subangular blocky structure; nonsticky and nonplastic; many roots; 8 percent mineral material; neutral; diffuse boundary.

Oa2—13 to 36 inches; very dark brown (10YR 2/2) broken face; dark reddish brown (5YR 2/2) pressed and very dark grayish brown (10YR 3/2) rubbed sapric material; 20 percent fiber, 3 percent rubbed; moderate fine subangular blocky structure; slightly sticky and slightly plastic; few roots; 10 percent mineral material; neutral; diffuse boundary.

Oa3—36 to 63 inches; very dark grayish brown (10YR 3/2) broken face; very dark gray (10YR 3/1) pressed and rubbed sapric material; 25 percent fiber, 5 percent rubbed; very weak fine subangular blocky structure; slightly sticky and slightly plastic; no roots; 15 percent mineral material; neutral; gradual boundary.

Oe—63 to 70 inches; yellowish brown (10YR 5/4) broken face; dark brown (10YR 3/3) pressed and rubbed hemic material; 75 percent fiber, 25 percent rubbed; massive; slightly sticky and nonplastic; no roots; 5 percent mineral material; neutral; clear boundary.

IILca—70 to 162 inches; light brownish gray (10YR 6/2) marl; gray in lower part; 5 percent fiber in upper part, 1 percent below 84 inches; few shells.

The organic deposits are more than 51 inches thick. They are medium acid to neutral in the upper 70 inches. Woody fragments that consist of twigs, branches, logs, or stumps make up 15 to 30 percent, by volume, of most profiles and range from ¼ inch to more than 1 foot in diameter.

The surface tier has hue of 5YR to 10YR, value of 2, and chroma of 1 or 2. It is predominantly sapric material, but some tiers contain hemic material and others have various proportions of both sapric and hemic materials.

The subsurface tier has hue of 5YR to 10YR, value of 2 or 3, and chroma of 0 to 3. It is dominated by sapric material that has a rubbed fiber content of less than 10 percent of the organic volume.

The bottom tier is similar to the subsurface tier in color and has variable amounts of woody and herbaceous layers, but herbaceous fibers generally make up the greater part.

Carlisle soils are closely associated with Palms muck and Edwards muck. Carlisle muck is more than 51 inches deep to marl or mineral material, whereas Palms and Edwards muck are less than 51 inches deep to marl or mineral material.

Cc—Carlisle muck. This muck soil is in areas where old lakes have been filled with organic matter. These areas in their natural condition are ponded or have ground water within a few inches of the surface. Areas near the villages of Wayland, Arkport, and Bath are underlain by a substratum of marl. Sedimentary peat is in the Prattsburg area at about a depth of 12 feet. These areas are or have been cleared of trees and used for vegetable crops. The area at Caton is in its natural state.

Included with this soil in mapping were small areas where mineral soils cover the muck to a depth of about 24 inches and areas of Palms muck. Palms muck generally is at the edge of the bog area and is in the Arkport area as islands in Carlisle muck.

The soil is excellent for vegetable crops when it is cleared and properly drained. After it is drained, this soil shrinks and settles as a result of compaction, decomposition, and soil blowing. Controlled drainage on this soil is generally needed to accommodate the

moisture needs of crops and to reduce the amount of shrinkage and rate of decomposition. If this soil is intensively used, the structure of the surface layer breaks down and the soil is highly susceptible to blowing. Windbreaks are needed to help reduce soil loss and crop damage and to help prevent drainage ditches from becoming plugged and ineffective. The only nonfarm uses of this soil would be sites for nature study and as sources of gardening peat. Capability subclass IIIw; woodland subclass 5w.

Chenango Series

The Chenango series consists of deep, well drained to somewhat excessively drained soils that formed in gravelly or channery materials on old gently sloping alluvial fans.

In a representative profile the surface layer is dark brown channery silt loam about 8 inches thick. The subsoil extends to a depth of 34 inches. In the upper 9 inches it is brown to dark brown friable channery silt loam and in the lower 17 inches it is brown to dark brown, very friable, very channery silt loam. The substratum from a depth of 34 to 60 inches is brown to dark brown loose very channery sandy loam.

The available water capacity is moderate. Permeability is moderately rapid in the solum and rapid in the substratum. The root zone in most places extends to a depth of 30 inches, but it is not restricted to that depth. If the soils are not limed, the surface layer is strongly acid. Droughtiness and coarse fragments are the main limitations to farm and nonfarm uses.

Representative profile of Chenango channery silt loam, fan, in a cultivated field in the town of Corning, 200 feet south of the intersection of Davenport Road and the Steuben-Chemung County line:

Ap—0 to 8 inches; dark brown (10YR 3/3) channery silt loam; moderate fine granular structure; friable; many medium roots; 20 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—8 to 17 inches; brown to dark brown (7.5YR 4/4) channery silt loam; weak medium subangular blocky structure; friable; common fine roots; 30 percent coarse fragments; strongly acid; abrupt smooth boundary.

B22—17 to 34 inches; brown to dark brown (10YR 4/3) very channery silt loam; very weak subangular blocky structure; very friable; few fine roots; 40 percent coarse fragments; strongly acid; clear wavy boundary.

IIC—34 to 60 inches; brown to dark brown (10YR 4/3) very channery sandy loam; single grained; loose; few fine roots in upper part; 50 percent coarse fragments; slightly acid.

Depth to bedrock is mainly 10 feet or more. The solum is 24 to 36 inches thick. Coarse fragments which are mainly angular and include flagstones, gravel, and cobblestones make up 50 to 70 percent of the C horizon and 20 to 60 percent of the B horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR through 2.5Y, value of 4 or 5, and chroma of 3 or 4. The fine earth fraction ranges from fine sandy loam to silt loam and is strongly acid or medium acid.

The C horizon has hue of 2.5Y or 10YR, value of 3 or 4, and chroma of 2 or 3. It ranges from very channery sandy loam to very gravelly loamy sand. Reaction ranges from strongly acid in the upper part to slightly acid in the lower part.

Chenango soils are near Alton and Braceville soils. They are more loamy and less sandy than Alton soils and are better drained than Braceville soils.

Ch—Chenango channery silt loam, fan. This is a gently sloping soil that formed in fan-shaped, alluvial areas where streams from the uplands poured out onto nearly level valley floors. The alluvium is mainly rounded gravelly and channery fragments. The fragments are largest and deepest at the apex of the fan. The fan slopes toward the valley floor and spreads laterally along the foot slope of the hill. It is steeper and drier near the apex and is wettest from seepage where the deposit is thinnest. The areas range from several acres to 50 acres in size.

Included with this soil in mapping were small areas of moderately well drained Braceville and somewhat poorly drained Red Hook soils.

This soil is suited to all crops grown in the county, including hay, pasture, and trees. It is widely used for building sites and housing developments. Most of the village of Hammondsport is on this soil.

This soil is easy to work, and it warms up early in spring. In a few places rock fragments interfere with tillage. Flooding is a continuous hazard and should be considered in planning any nonfarm use. Planting on the contour and maintaining plant cover on slopes help control erosion. Returning crop residue to the soil and growing a winter cover crop are necessary in cultivated areas. Flooding, a moderate hazard of erosion, and nutrient deficiencies are the main limitations to farming. Capability subclass IIs; woodland subclass 3o.

Chippewa Series

The Chippewa series consists of deep, poorly drained soils that formed in glacial till that was derived mainly from siltstone, sandstone, and shale. These soils are in drainageways and in nearly level to slightly concave areas on till plains.

In a representative profile, in a cultivated area, the surface layer is very dark grayish brown channery silt loam about 6 inches thick. Below the surface layer there is a leached layer of mottled grayish brown channery silt loam about 7 inches thick. The subsoil is a firm and brittle fragipan of channery silt loam. In the upper 11 inches it is mottled dark gray and in the lower 16 inches it is mottled grayish brown. The substratum to a depth of 64 inches is gray and yellowish brown firm channery silt loam.

The available water capacity is moderate. In spring and in wet periods, the water table is at or near the surface. The fragipan is very slowly permeable. Plant roots do not penetrate the fragipan except along the sides of prisms. Plants are rarely affected by lack of moisture because the soils are generally saturated in the spring, and water from adjacent areas seeps into them long after periods of rainfall. If the soils are not limed, the surface layer is very strongly acid. Wetness and ponding are the main limitations to farm and nonfarm uses.

Representative profile of Chippewa channery silt

loam, in the town of Bath, south of the road into Mossy Bank Park, about 1 mile south of the village of Bath:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) channery silt loam; weak very fine granular structure; very friable; many roots; 20 percent coarse fragments; medium acid; abrupt smooth boundary.

A2g—6 to 13 inches; grayish brown (2.5Y 5/2) channery silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; few roots; few fine pores; 20 percent coarse fragments; medium acid; clear smooth boundary.

Bxlg—13 to 24 inches; dark gray (5Y 4/1) channery silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prisms 4 to 8 inches across with gray (N 5/0) wedges of silt loam separated from the interiors of the prisms by yellowish brown (10YR 5/8) coats; massive inside prisms; firm and brittle; few roots extend down prism faces; few fine pores; 20 percent coarse fragments; strongly acid; gradual wavy boundary.

Bx2g—24 to 40 inches; grayish brown (10YR 5/2) channery silt loam; common fine faint gray (10YR 6/1) mottles; moderate very coarse prisms with gray (N 5/0) silt coats from above horizon extending downward to a depth of 36 inches; massive inside prisms; firm and brittle; few fine pores; 30 percent coarse fragments; strongly acid; gradual wavy boundary.

C—40 to 64 inches; 50 percent gray (10YR 6/1) and 50 percent yellowish brown (10YR 5/4) channery heavy silt loam; massive; firm; few pores; 35 percent coarse fragments; medium acid.

Depth to bedrock is more than 5 feet. The solum is 36 to 56 inches thick. Coarse fragments make up as much as 30 percent of the surface horizons and 20 to 35 percent of the Bx and C horizons.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. Reaction, if the soil is not limed, is very strongly acid or strongly acid.

The A2 horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2. Reaction, if the soil is not limed, is very strongly acid or strongly acid.

The Bx horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 through 4. Reaction ranges from strongly acid to slightly acid.

The C horizon is similar to the Bx horizon in color and texture, but it has a weak or moderate thick platy structure or it is massive. Reaction ranges from medium acid to neutral.

Chippewa soils are near Volusia and Tuller soils. They are wetter than Volusia soils and deeper to rock than Tuller soils.

Ck—Chippewa channery silt loam. This nearly level soil is in saucer-shaped depressions and drainageways in all parts of the county. The areas are irregularly shaped and range from less than 2 acres to more than 20 acres in size.

Included with this soil in mapping were small areas of very poorly drained Alden soils and somewhat poorly drained Volusia soils, and small areas of a poorly drained, medium textured soil that has bedrock at a depth of 20 to 40 inches. A few small areas, in the town of Pulteney in the northern part of the county, where the soils are neutral in reaction were also included.

If this soil is not drained, it is unsuited to crops. If it is completely drained, it is suited to corn, oats, and hay. Many areas are excellent sites for ponds. Artificial drainage is desirable if wet spots are in cultivated fields. Drainage outlets, however, are often difficult to locate. Because the soil is wet and cold in spring, crops respond to early applications of nitrogen. Wetness is the principal limitation to farming. Capability subclass IVw; woodland subclass 5w.

Collamer Series

The Collamer series consists of deep, moderately well drained soils that formed in lake-laid silt, very fine sand, and clay. These rolling soils are in glacial lake deposits in valleys.

In a representative profile, in a cultivated area, the surface layer is brown to dark brown silt loam about 8 inches thick. It is underlain by a thin leached layer of pale brown heavy silt loam about 3 inches thick. The subsoil is 28 inches thick. In the upper 3 inches it is light olive brown silty clay loam and pale brown silt loam; in the 7 inches below that it is mottled brown firm silty clay loam; and in the lower 18 inches it is mottled brown to dark brown firm silty clay loam. The underlying material to a depth of 60 inches is dark grayish brown firm silt loam.

The available water capacity is high. Permeability is moderately slow. Early in spring and in wet periods, a temporary high water table is present for brief periods. The root zone in most places is restricted to a depth of 18 to 24 inches.

Representative profile of Collamer silt loam, rolling, in the town of Urbana, along State Route 54 about ½ mile southeast of Pleasent Valley:

Ap—0 to 8 inches; brown to dark brown (10YR 4/3) silt loam; moderate very fine subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—8 to 11 inches; pale brown (10YR 6/3) heavy silt loam; weak medium subangular blocky structure; firm; many roots; few fine pores; strongly acid; clear wavy boundary.

A&B—11 to 14 inches; 40 percent light olive brown (2.5Y 5/4) silty clay loam surrounded by pale brown (10YR 6/3) silt loam; moderate coarse subangular blocky structure; firm; common roots; many fine pores with clay linings in a few pores; strongly acid; clear wavy boundary.

B21t—14 to 21 inches; brown (10YR 5/3) silty clay loam; common medium distinct very pale brown (10YR 7/3) and yellowish brown (10YR 5/4) mottles; moderate coarse angular blocky structure; firm; few roots; many pores with clay linings; patchy clay films on ped surfaces; medium acid; clear wavy boundary.

B22t—21 to 39 inches; brown to dark brown (10YR 4/3) silty clay loam; common fine distinct light yellowish brown (10YR 6/4) mottles; moderate coarse angular blocky structure; firm; few roots; many pores with clay linings; neutral; gradual wavy boundary.

C—39 to 60 inches; dark grayish brown (10YR 4/2) silt loam; strong medium platy structure; firm; moderately alkaline; calcareous.

Depth to bedrock is more than 5 feet. The solum is 30 to 40 inches thick. The soils are typically free of coarse fragments, but many profiles contain a few stones or pebbles. Carbonates are at a depth of 30 inches to 6 feet.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. Reaction ranges from strongly acid to neutral.

The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4.

The B horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam. The B2 horizon ranges from medium acid to neutral.

The C horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 2 or 3. It is silty clay loam or silt loam and ranges from slightly acid to moderately alkaline.

Collamer soils are in a drainage sequence with well drained Dunkirk soils, somewhat poorly drained Niagara soils, and poorly drained Canandaigua soils.

CoC—Collamer silt loam, rolling. This rolling soil is on the sides and tops of small knolls in valley areas. The largest areas are in the township of Wheeler along Five Mile Creek. The areas are only a few acres in size. Slopes are complex and generally short, and they range from about 6 to 15 percent.

Included with this soil in mapping were small areas of well drained Dunkirk soils and somewhat poorly drained Niagara soils and spots that were moderately eroded and other areas that contain gravel at a depth of about 3 feet below the surface.

This soil is suited to cultivated crops, hay, pasture, and trees. The hazard of erosion is severe if this soil is used for row crops and is not protected. Diversion terraces and contour stripcropping, returning crop residue to the soil, and growing sod crops help control erosion. In many places the irregular slopes make contour stripcropping and diversion terraces impractical. Seasonal wetness, moderate slope, the hazard of erosion, and a tendency of cut slopes to slump are the main limitations to consider in the use of this soil. Capability subclass IIIe; woodland subclass 2r.

Dunkirk Series

The Dunkirk series consists of deep, well drained soils that formed in lake-laid silt, very fine sand, and clay. These soils are rolling and hilly and are in glacial lake deposits in valleys.

In a representative profile, in a cultivated area, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is pale brown, friable silt loam about 6 inches thick. The subsoil is 25 inches thick. In the upper 8 inches it is yellowish brown silt loam; in the 7 inches below that it is dark yellowish brown friable heavy silt loam; and in the lower 10 inches it is dark yellowish brown firm heavy silt loam. The underlying material from a depth of 39 to 60 inches is brown stratified silt and very fine sand.

The available water capacity is high. Permeability is moderately slow. The root zone in most places extends to a depth of 30 inches, but it is not restricted to that depth. These soils are very erodible. The moderately slow permeability and the hazard of erosion are the main limitations in the use of this soil.

Representative profile of Dunkirk silt loam, rolling, in a cultivated field in the town of Wayland, near abandoned railroad on County Route 90, ½ mile east of the Steuben-Livingston County line:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium and coarse granular structure; friable; many roots; 3 percent coarse fragments; medium acid; clear smooth boundary.

A2—8 to 14 inches; pale brown (10YR 6/3) silt loam; very weak medium subangular blocky structure; friable; many roots; many fine pores; medium acid; clear wavy boundary.

B&A—14 to 22 inches; yellowish brown (10YR 5/4) heavy silt loam; peds surrounded by pale brown (10YR 6/3) coats 2 millimeters thick; weak medium subangular blocky structure; friable; common roots; many fine pores; few thin clay films in pores; medium acid; gradual wavy boundary.

B21t—22 to 29 inches; dark yellowish brown (10YR 4/4) heavy silt loam; weak medium and coarse subangular blocky structure; friable; few roots; common fine pores; patchy clay films on ped surfaces; clay linings in pores; slightly acid; clear wavy boundary.

B22t—29 to 39 inches; dark yellowish brown (10YR 4/4) heavy silt loam; weak coarse subangular blocky structure; firm; few roots; common fine pores; clay films less than 1 millimeter thick on 30 percent of ped faces and in most pores; slightly acid; gradual wavy boundary.

C—39 to 60 inches; brown (10YR 5/3) stratified silt and very fine sand; massive; firm; slightly acid.

Depth to bedrock is more than 60 inches. The solum is 36 to 45 inches thick. The soils are generally free of coarse fragments, but some profiles contain a few cobbles or pebbles.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2. Reaction ranges from strongly acid to neutral.

The A2 horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 2 or 3. Reaction ranges from strongly acid to neutral.

The B horizon has hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam and ranges from medium acid to mildly alkaline.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. Reaction ranges from slightly acid to mildly alkaline and becomes more alkaline as the depth increases.

Dunkirk soils are in a drainage sequence with moderately well drained Collamer soils and somewhat poorly drained Niagara soils. Dunkirk soils are adjacent to areas of Howard soils but lack the gravel content of Howard soils.

DuC—Dunkirk silt loam, rolling. This rolling soil is on the sides of knolls in valleys. The areas conform to the shape of the knolls but are generally round and 10 to 20 acres in size. Slopes are short and range from 5 to 15 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Collamer and Canaseraga soils on similar landforms. Also included because of its low acreage was a well drained soil that had bands of sandy material in the subsoil. Small areas of undulating Dunkirk soils and, in some places, stratified sand and gravel at a depth of 4 to 6 feet were also included.

This soil is suited to cultivated crops, hay, pasture, and trees. It is free of stones and is easy to cultivate. The hazard of erosion is severe if row crops are grown and the soil is not protected. Diversion terraces and contour stripcropping, returning crop residue to the soil, and growing sod crops help control runoff and erosion. In many places the short irregular slopes make contour stripcropping impractical. Minimum tillage also helps control runoff and erosion. Capability subclass IIIe; woodland subclass 2r.

DuD—Dunkirk silt loam, hilly. This soil is on hilly knolls in valleys. Narrow drainageways are common to the landscape. The areas are 10 to 40 acres in size. Slopes are short, tilt in various directions, and range from 15 to 30 percent.

Included with this soil in mapping were small areas of Howard and Madrid soils, a well drained soil that has bands of sandy material in the subsoil, a few spots of severely eroded soils, and some areas where stratified sand and gravel are at a depth of 4 to 6 feet.

This soil is suited to hay, pasture, and trees, but it is better suited to sod crops and close growing grain crops. It is poorly suited to cultivated crops because the hazard of erosion and the complex slopes prevent

the use of contour measures to control runoff and erosion.

This soil is easy to work throughout a fairly wide range of moisture content. Steep areas are difficult and hazardous to work. Minimum tillage is needed to reestablish hay or pasture. Capability subclass IVe; woodland subclass 2r.

Edwards Series

The Edwards series consists of very poorly drained soils that have 16 to 49 inches of well decomposed organic material over calcareous marl. These soils are in bogs.

In a representative profile the surface layer is black muck about 7 inches thick. It is underlain by mucky material that extends to a depth of 30 inches. In the upper 8 inches and lower 5 inches this mucky material is black; in the middle 10 inches it is very dark grayish brown. The underlying material from a depth of 30 to 60 inches is light gray marl.

The available water capacity is high. Permeability is rapid in the organic material. The water table is at or near the surface for prolonged periods. If the soil is not limed, the surface layer is slightly acid or neutral. Wetness and lack of drainage outlets are the principal limitations to farming.

Representative profile of Edwards muck, at the east edge of the village of Bath, just south of State Route 415, in a swamp near sewage treatment plant:

Oa1—0 to 7 inches; black (N 2/0) broken face; pressed and rubbed sapric material; 3 percent fiber; none rubbed; weak fine subangular blocky structure; friable roots; 8 percent mineral material; neutral.

Oa2—7 to 15 inches; black (5YR 2/1) broken face; pressed and rubbed sapric material; 2 percent fiber; none rubbed; moderate fine subangular blocky structure; friable; common roots; 8 percent mineral material; neutral.

Oa3—15 to 25 inches; very dark grayish brown (10YR 3/2) broken face; very dark brown (10YR 2/2) pressed and rubbed sapric material; 30 percent fiber; 9 percent fiber rubbed; moderate medium subangular blocky structure; friable; 8 percent mineral material; common fine shells in lower part; neutral.

Oa4—25 to 30 inches; black (5YR 2/1) broken face; very dark brown (10YR 2/2) pressed and rubbed sapric material; 25 percent fiber; 8 percent fiber rubbed; 8 percent mineral material; moderately alkaline; calcareous.

IILca—30 to 60 inches; light gray (10YR 7/2) marl; massive; friable; moderately alkaline; calcareous.

Depth to the IILca horizon ranges from 16 to 40 inches. The organic material ranges from medium acid to moderately alkaline. Free carbonates are immediately above the marl contact.

The surface tier is neutral black or has hue of 10YR, value of 2, or chroma of 1 or 2. Rubbed fiber makes up less than 10 percent of the surface tier.

The subsurface tiers have hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 or 2.

The IILca horizon has hue of 10YR, value of 5 to 7, chroma of 1 or 2. Reaction ranges from mildly alkaline to moderately alkaline.

Ed—Edwards muck. This nearly level organic soil is in areas near the villages of Wayland, Arkport, and Bath where glacial lakes have been filled with organic matter. Nearly all of these areas were cleared at one time, but they are now in brush and woodland. The areas are 5 to 40 acres in size.

Unless this soil is drained, it is not suited to farming. It is well suited to wetland wildlife habitat. The thickness of the organic material over marl is variable, and, if drainage is considered, onsite investigation is needed. Capability subclass IVw; woodland subclass 4w.

Fluvaquents and Ochrepts

FL—Fluvaquents and Ochrepts. These soils were formerly called Alluvial land. They consist of mixed alluvial material that ranges from clay to large boulders but is dominantly loamy or silty material. These soils occur in narrow strips along streams and rivers. The natural drainage ranges over short distances from well drained to very poorly drained. Slope ranges from 0 to about 8 percent.

Included in mapping were small areas of Tioga, Middlebury, and Wayland soils and areas of riverwash.

This soil is frequently flooded; hence it is poorly suited to farming. Some cleared areas are used for pasture, and others are reverting to brush and trees. Many areas have a cover of water-tolerant trees and shrubs. Pastures are difficult to manage because steep banks limit access to them and separate them from adjoining fields.

The major limitations for most uses are variable texture, hazard of flooding, and wetness. Capability subclass Vw; woodland subclass not assigned.

Fremont Series

The Fremont series consists of deep, somewhat poorly drained soils that formed in glacial till that was derived from shale, siltstone, and sandstone. These soils are nearly level to steep and are on broad hilltops in the uplands.

In a representative profile the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is firm silt loam about 22 inches thick. In the upper 7 inches it is mottled light olive brown and in the lower 15 inches it is mottled olive. The underlying material from a depth of 32 to 60 inches is mottled grayish brown channery heavy silt loam.

The available water capacity is high. Permeability in the subsoil is moderately slow. In the wetter season a water table is perched above the slowly permeable substratum. If the soil is not limed, the surface layer is strongly acid. Seasonal wetness and the hazard of erosion are the principal limitations to farm and nonfarm uses.

Representative profile of Fremont silt loam, 2 to 8 percent slopes, in a cultivated field in the town of Fremont, 2 miles east of State Route 21 and County Route 54, and 1 mile south of County Route 54:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many roots; 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—10 to 17 inches; light olive brown (2.5Y 5/4) silt loam; many medium distinct strong brown (7.5YR 5/8) and light gray (5Y 6/1) mottles; moderate medium subangular blocky structure; firm; ped faces coated with pale olive (5Y 6/3) silt; common fine roots;

10 percent coarse fragments; strongly acid; clear wavy boundary.

B22—17 to 32 inches; olive (5Y 5/3) heavy silt loam; common medium distinct strong brown (7.5YR 5/6) and light gray (10YR 7/1) mottles; weak coarse subangular blocky structure; firm; peds are coated with light brownish gray (2.5Y 6/2) silt; few fine roots; 10 percent coarse fragments; strongly acid; gradual wavy boundary.

C—32 to 60 inches; grayish brown (2.5Y 5/2) channery heavy silt loam; common medium distinct yellowish brown (10YR 5/6)) mottles; massive; firm; 15 percent coarse fragments; medium acid.

Depth to bedrock, which is typically shale, ranges from 40 inches to many feet. The solum is 24 to 37 inches thick. The fine earth fraction of the solum is silt loam or light silty clay loam. Coarse fragments make up 10 to 20 percent of the solum and 15 to 50 percent of the C horizon. Reaction ranges from very strongly acid to medium acid in the A and B horizons and from medium acid to neutral in the C horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 2 through 4.

The C horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 1 or 2. It is silt loam or light silty clay loam.

The Fremont soils are near Hornell and Volusia soils. They are coarser textured and deeper to bedrock than Hornell soils. They lack the fragipan of the Volusia soils.

FrB—Fremont silt loam, 2 to 8 percent slopes. This gently sloping soil is in broad, slightly convex plateau areas in the northwestern part of the county where runoff is somewhat slow and persists for significant periods. The areas are variable in size and shape. This soil has the profile described as representative of the series.

Included with this soil in mapping were areas of somewhat poorly drained Volusia soils that make up as much as 30 percent of some mapped areas but that have little or no effect on use and management, and spots of wetter Chippewa and Kanona soils in low areas and along drainageways.

This soil is suited to cultivated crops, hay, pasture, and trees. It has some potential for potato production because the low stone content makes the use of mechanical harvesters easy. The soil is wet in spring, but it dries out evenly without numerous troublesome seep spots. The hazard of erosion is moderate in the more sloping areas if this soil is cultivated and not protected. Lime and fertilizer needs are great. Capability subclass IIIw; woodland subclass 3w.

Hornell Series

The Hornell series consists of moderately deep, somewhat poorly drained soils that formed in shaly glacial till about 20 to 40 inches deep over soft shale bedrock. These soils are on gently sloping to steep uplands.

In a representative profile the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is 26 inches thick. In the upper 3 inches it is mottled yellowish brown silty clay loam; in the 8 inches below that it is mottled light olive brown firm silty clay; and in the lower 15 inches it is mottled olive brown firm silty clay. The underlying material to a depth of 38 inches is mottled olive gray firm shaly silty clay. Soft shale bedrock is at a depth of 38 inches.

The available water capacity is moderate. A seasonal high water table is perched above the very slowly permeable substratum. The root zone in most places is restricted to a depth of 20 inches. If the soil is not limed, the surface layer is strongly acid. Seasonal wetness and very slow permeability are the major limitations to farm and nonfarm uses.

Representative profile of Hornell silt loam, from an area of Hornell-Fremont silt loams, 1 to 6 percent slopes, in a hayfield in the town of Troupsburg, 20 feet south of County Route 83, ⅔ mile west of Chenango cemetery:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; strong fine and medium granular structure; friable; many fine roots; many pores; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—7 to 10 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; strong medium coarse and subangular blocky structure; firm; sticky and slightly plastic; light yellowish brown (10YR 6/4) silt coats on ped faces; common fine roots between peds; few fine pores; 5 percent hard coarse fragments; few soft shale fragments; very strongly acid.

B22—10 to 18 inches; light olive brown (2.5Y 5/4) silty clay; many coarse distinct strong brown (7.5YR 5/6) and common medium distinct light brownish gray (10YR 6/2) mottles; strong medium prisms parting to moderate medium and coarse subangular blocky; firm; few roots between peds; few fine pores; exteriors of peds 90 percent light olive gray (5Y 6/2); 5 percent hard coarse fragments; common soft shale fragments; very strongly acid; clear wavy boundary.

B3—18 to 33 inches; olive brown (2.5Y 4/4) silty clay; many medium distinct yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) mottles; moderate coarse prisms separate to weak thick platy structure; firm; few fine pores; ped faces are gray (5Y 6/1); 2 percent hard coarse fragments; many soft fragments of shale; very strongly acid; clear wavy boundary.

C—33 to 38 inches; olive gray (5Y 5/2) shaly silty clay; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; firm; ped faces are gray (5Y 5/1); few pores; 30 percent soft shale fragments; very strongly acid; abrupt wavy boundary.

R—38 to 50 inches; gray (5Y 5/1) thin bedded soft shale; dark brown stains along parting planes; strongly acid when powdered.

Depth to bedrock ranges from 20 to 40 inches. The solum is 20 to 36 inches thick. Soft fragments of shale make up as much as 20 percent of the upper horizons and 15 to 35 percent of the lower horizons. Hard, coarse fragments make up as much as 20 percent throughout.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 through 5, and chroma of 2. It is silt loam or silty clay loam. Reaction, if the soil is not limed, ranges from strongly acid to extremely acid.

The B horizon has hue of 10YR through 5Y, value of 4 or 5, and chroma of 3 or 4. It is heavy silty clay loam or silty clay. Reaction ranges from extremely acid to strongly acid.

The C horizon has hue of 10YR through 5Y, value of 5, and chroma of 1 or 2. It ranges from silty clay loam to clay and is strongly acid or very strongly acid.

Hornell soils are near Fremont and Kanona soils. Hornell soils are shallower to bedrock than Fremont and Kanona soils. They are also finer textured than Fremont soils.

HfB—Hornell-Fremont silt loams, 1 to 6 percent slopes. This mapping unit is commonly in ridgetop areas

of uplands where runoff is somewhat slow. The areas are roughly oblong and are about 5 to 40 acres in size. This mapping unit is about 60 percent Hornell soils and 40 percent Fremont soils. These nearly level to gently sloping soils have the profile described as representative of their series.

Included in mapping were small areas of shallow Arnot and Tuller soils where hard sandstone bedrock is at a depth of 20 inches or less, spots of poorly drained to somewhat poorly drained Kanona soils that are similar to Arnot and Tuller soils but are deeper, and somewhat poorly drained Volusia soils that are coarser textured and have a strongly expressed fragipan.

This mapping unit is suited to cultivated crops, hay, pasture, and trees. The hazard of erosion is moderate in the more sloping areas if the soils are cultivated and not protected. Unless the soils are artificially drained, seasonal wetness delays planting and affects the choice of crops that can be grown. Diversions that break up long slopes, grassed waterways, and drainage are ways to dispose of water. Returning plant residue to the surface and keeping tillage to a minimum help maintain soil tilth. Because the content of clay is high, the soils clod and puddle easily if they are tilled at the wrong moisture content. Capability subclass IIIw; woodland subclass 3w.

HfC—Hornell-Fremont silt loams, 6 to 12 percent slopes. This mapping unit is in side slope areas of ridges on uplands. The areas are long, variable in width, and commonly more than 20 acres in size. This mapping unit is about 55 percent Hornell soils and about 40 percent Fremont soils. These sloping soils have a profile similar to that described as representative of their series, but their subsoil is thinner in most places.

Included in mapping were small areas of similar but deeper, poorly drained to somewhat poorly drained Kanona soils in low areas and along drainage dissections, spots of somewhat poorly drained Volusia soils and moderately well drained Mardin soils that are coarser textured and have a strongly expressed fragipan, and small areas of shallow, well drained to moderately well drained Arnot soils. In these latter areas, hard sandstone bedrock affects the relief.

This mapping unit is suited to cultivated crops, hay, pasture, and trees. The hazard of erosion is severe if the soils are cultivated and not protected. Unless intensive measures are used to control runoff and erosion, tillage should be used mostly to renovate hay and pasture sods.

Seasonal wetness delays planting and affects the choice of crops. The soils are wet in spring, but during long dry periods in midsummer plants show signs of moisture stress. Because of the high clay content, good tilth is difficult to maintain if these soils are tilled at the wrong moisture content. Returning plant residue and keeping tillage to a minimum help maintain soil tilth. Capability subclass IIIe; woodland subclass 3w.

HgD—Hornell and Fremont silt loams, 12 to 20 percent slopes. This undifferentiated group is on long side slopes below the crests of hills and on foot slopes below the steep valley sides. Areas consist either of Hornell soils or Fremont soils or some of both. The areas are moderately steep and about 10 to 40 acres in size.

Included in mapping were small areas of Kanona, Mardin, Volusia, and Lordstown soils and spots where the surface layer has been washed away by erosion.

This mapping unit is suited to hay, pasture, and trees. The moderately steep slopes make the use of farm equipment difficult and hazardous. These soils are susceptible to some erosion if they are not protected. Minimum tillage is needed to establish hay or pasture. Moderately steep slopes, the hazard of erosion, and slow permeability are major limitations to farm and nonfarm uses. Capability subclass IVe; Hornell part in woodland subclass 3w; Fremont part in woodland subclass 3r.

HHE—Hornell and Fremont silt loams, steep. This undifferentiated group is on steep valley side walls. Areas consist either of Hornell soils or Fremont soils or some of both. The areas are very large; some are several miles long. Slopes range from 20 to 60 percent.

Included in mapping were small areas of Lordstown and Arnot soils and spots that have been severely eroded.

This mapping unit is suited to trees and wildlife habitat. In some areas the view of the valley is excellent.

The steep slopes make the use of machinery very difficult and hazardous. Care must be taken in logging operations because these soils are very erodible when the vegetation has been removed. Steep slopes are the main limitation to farm and nonfarm uses. Capability subclass VIIe; woodland subclass 3r.

HkD3—Hornell and Fremont silty clay loams, 6 to 20 percent slopes, severely eroded. This mapping unit is at the foot of steeper slopes where it receives runoff from adjacent areas. Hornell soils, Fremont soils, or some of both make up the areas. The areas are small; they generally are less than 5 acres and are cut by many shallow erosion channels. These gently sloping to moderately steep soils have a profile similar to that described as representative of their series, but erosion has completely removed the surface layer and much of the upper part of the subsoil.

Included in mapping were small areas of Kanona soils and other less eroded Hornell and Fremont soils.

This mapping unit in its present state is not suited to good plant growth. Eroded areas have remained nearly barren of vegetation for 20 years. To establish vegetative growth, surface water from adjacent areas must be excluded and a mulch added to increase moisture-holding capacity and to minimize erosion. Liberal amounts of lime and fertilizer are needed. Moderate slopes and the high content of clay in the surface layer and the subsoil are the major soil features to consider in nonfarm use. Capability subclass VIe; woodland subclass 3r.

Howard Series

The Howard series consists of deep, well drained to somewhat excessively drained soils that formed in glacial outwash that was derived from limestone, sand-

stone, and shale. These soils are nearly level to steep and occupy outwash plains, valley trains, and kame terraces.

In a representative profile the surface layer is dark brown gravelly loam about 9 inches thick. The subsurface layer is brown friable gravelly loam about 6 inches thick. The subsoil is very gravelly loam about 30 inches thick. In the upper 9 inches the subsoil is pale brown; in the 3 inches below that it is brown; and in the lower 18 inches it is dark brown. The substratum is loose grayish brown very gravelly sand.

The available water capacity to the depth of 30 inches is low to moderate. Permeability is moderate to moderately rapid in the solum and very rapid in the substratum. The root zone in most places extends to a depth of 30 inches, but it is not restricted to that depth. If the soils are not limed, the surface layer is medium acid.

Representative profile of Howard gravelly loam, 0 to 3 percent slopes, in a cultivated area in the town of Howard, near junction of State Route 70 and County Route 27, just west of hamlet of Howard:

Ap—0 to 9 inches; dark brown (10YR 3/3) gravelly loam; weak fine granular structure; friable; many fine roots; 30 percent gravel; medium acid; abrupt smooth boundary.

A2—9 to 15 inches; brown (10YR 4/3) gravelly loam; weak fine granular structure; friable; many fine roots; 30 percent gravel; medium acid; gradual wavy boundary.

A&B—15 to 24 inches; pale brown (10YR 6/3) very gravelly loam; very weak fine subangular blocky structure; friable; common fine roots; many medium and large pores; ped interiors are dark brown (10YR 4/3) with clay linings in pores; 40 percent gravel; slightly acid; clear irregular boundary.

B&A—24 to 27 inches; brown (10YR 4/3) very gravelly loam; weak fine and medium subangular blocky structure; friable; common fine roots; common fine pores; surface of peds coated with 1 to 2 millimeters of pale brown (10YR 6/3) material; 50 percent gravel; slightly acid; clear irregular boundary.

B21t—27 to 30 inches; dark brown (10YR 4/3) very gravelly loam; weak fine and medium subangular blocky structure; firm, slightly sticky, slightly plastic; common fine roots; common fine pores; clay coats are thin on peds and thick on pebbles; 50 percent gravel; slightly acid; gradual irregular boundary.

B22t—30 to 45 inches; dark brown (7.5YR 4/4) very gravelly loam; weak medium subangular blocky structure; firm, slightly sticky, slightly plastic; few fine roots; common fine pores with clay linings; thick patchy clay coats on pebbles and surface of peds; 60 percent gravel; neutral; abrupt irregular boundary.

IIC—45 to 72 inches; grayish brown (10YR 5/2) very gravelly sand; single grained; loose; few fine roots; calcareous; moderately alkaline.

The solum is 24 to 53 inches thick. It is medium acid to neutral, and the substratum is mildly alkaline or moderately alkaline. Coarse fragments make up 20 to 40 percent of the Ap, A2, and A&B horizons and 40 to 60 percent of the B and C horizons. Carbonates are at a depth of 24 to 53 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 through 6, and chroma of 2 or 3.

The B horizon has hue of 5YR through 10YR, value of 3 through 5, and chroma of 3 or 4. It ranges from sandy loam to sandy clay loam.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is dominantly stratified layers of sand and gravel.

Howard soils are near Alton and Braceville soils. They are more loamy and less sandy than Alton soils and better drained than Braceville soils.

HoA—Howard gravelly loam, 0 to 3 percent slopes. This nearly level soil is on glacial outwash terraces along the larger streams in all parts of the county. The areas are generally 10 to 40 acres in size. This soil has the profile described as representative of the series.

Included within this soil in mapping were small areas of well drained Unadilla soils and moderately well drained Braceville soils.

This soil is suited to all crops grown in the county, including hay, pasture, and trees. It is a good source of gravel and is one of the best soils in the county for many nonfarm uses.

This soil is easy to work, and it warms up early in spring. Returning crop residue to the soil and growing a winter cover crop are necessary in cultivated areas. Droughtiness can be a problem in dry periods. A few wet spots need artificial drainage. Capability subclass IIs; woodland subclass 2o.

HoB—Howard gravelly loam, undulating. This soil is on glacial outwash terraces and plains in areas of complex slopes and kettle and kame topography. The areas are large; many exceed 50 acres. Slopes are short and range from 3 to 12 percent.

Included with this soil in mapping were small areas of well drained Madrid soils.

This soil is suited to cultivated crops, hay, pasture, and trees. It is generally a good source of gravel and is suited to many nonfarm uses.

Lack of moisture is more frequently a limitation on this soil than it is on the more level Howard soils. The hazard of erosion is slight if this soil is cultivated and not protected. Planting on the contour helps control erosion. Returning crop residue to the soil and growing a winter cover crop are necessary in cultivated areas. Capability subclass IIs; woodland subclass 2o.

HoC—Howard gravelly loam, rolling. This soil is on valley sides and hillsides on uplands. The areas are generally 10 acres or more in size. Slopes are short and irregular, and they range from 12 to 20 percent. This soil has a profile similar to the one described as representative of the series, but the subsoil is thinner and the sandy and gravelly substratum is closer to the surface.

Included with this soil in mapping were small areas of Bath and Canaseraga soils.

This soil is suited to hay, pasture, and trees. It is a good source of gravel (fig. 7).

The irregular, complex slopes make the use of machinery difficult, and contouring practices are not feasible in many places. The hazard of erosion is serious if this soil is cultivated and not protected. Because of the hazard of erosion and the difficulty in working this soil, sod crops are more practical to grow than row crops. Many pastures are productive in spring and in fall but droughty in midsummer. Capability subclass IVe; woodland subclass 2r.

HpD—Howard-Dunkirk complex, hilly. This mapping unit is on kames in valleys. The areas are several hundred acres in size. Slopes are irregular and range

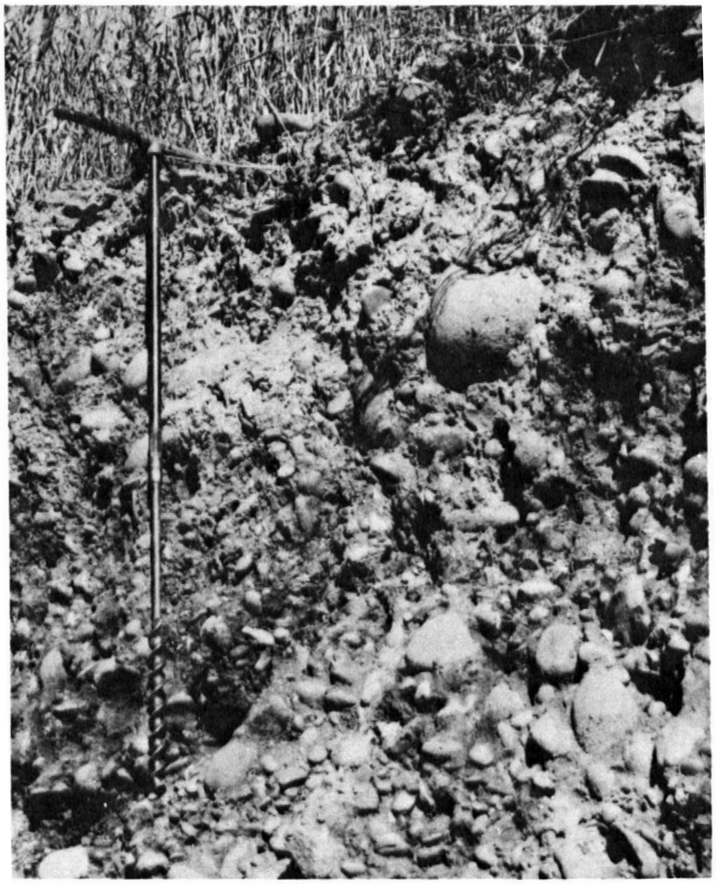

Figure 7.—**A Howard soil that has a high content of gravel fragments.**

from 12 to 30 percent. The Howard soil makes up about 60 percent of this complex. It has a profile similar to the one described as representative of its series, but the subsoil is thinner than in the representative profile. The Dunkirk soil makes up about 40 percent of the complex. It has a profile similar to the one described as representative of its series, but gravel underlies the substratum.

Included in mapping were small areas of less sloping Howard soils and Dunkirk soils and a few areas of well drained soils that are sandy throughout the profile. In a few spots the soils are severely eroded.

This mapping unit is suited to hay, pasture, and trees. It is better suited to sod crops than to row crops.

In many areas the view adds to the potential for use as homesites. The moderately steep soils are susceptible to erosion and are very difficult and hazardous to cultivate. Slope is the main limitation to many nonfarm uses. Capability subclass IVe; woodland subclass 2r.

HrB—Howard-Madrid complex, undulating. This mapping unit is on the lesser slopes in valleys. The areas are 5 to 40 acres in size. Slopes are short and irregular, and they range from 3 to 12 percent. The mapping unit is about 50 percent Howard soils and 50 percent Madrid soils. The Madrid soil has a profile similar to the one described as representative of its series, but it is generally underlain by deposits of gravel.

Included in mapping were small areas of Canaseraga and Bath soils and small areas of deep, well drained, sandy soils which are not underlain by gravel.

This mapping unit is suited to cultivated crops, hay, pasture, and trees. It is well suited to many nonfarm uses.

The soils are easy to work, and they warm up early in spring. Planting on the contour helps control erosion. Returning crop residue to the soil and growing a winter cover crop are necessary in cultivated areas. Capability subclass IIs; woodland subclass 2o.

HrC—Howard-Madrid complex, rolling. This mapping unit is on the lower part of valley walls in rolling areas. The areas range from 5 to 20 acres in size. Slopes are short and irregular, and they range from 12 to 20 percent. This mapping unit is about 50 percent Howard soils and 50 percent Madrid soils.

Included in mapping were small areas of Bath, Canaseraga, and Alton soils. In the southwestern corner of the county, a few areas of soils are included that are similar to but redder than Alton soils.

These soils are suited to hay, pasture, and trees. Many areas provide a good source of gravel, and other areas that have a good view are used for homesites.

Complex slopes make the use of farm equipment difficult and hazardous. Because of the hazard of erosion and the difficulty in working these soils, sod crops are more practical to grow than row crops. Slope is the main limitation to nonfarm use. Capability subclass IVe; woodland subclass 2r.

HrD—Howard-Madrid complex, 20 to 30 percent slopes. This mapping unit is on steep sides of the lower valley walls. The areas range from 10 to 40 acres in size. This mapping unit is about 50 percent Howard soils and 50 percent Madrid soils. These moderately steep soils have a profile similar to that described as representative of their series, but their subsoil is thinner because of the steep slopes.

Included in mapping were small areas of Alton, Mardin, and Lordstown soils.

This mapping unit is suited to pasture and trees and is a good source of gravel. The less sloping areas are suited to hay crops.

Operating farm equipment is difficult and hazardous. Minimum tillage is necessary to reestablish a sod cover. Slope is a limitation to nonfarm use. Capability subclass IVe; woodland subclass 2r.

HtD—Howard and Alton gravelly soils, 20 to 30 percent slopes. This undifferentiated group is on terrace faces and hilly valley sides. Areas consist either of Howard soils or Alton soils or some of both. The areas range from 10 acres to 30 acres in size. These soils have a profile similar to that described as representative of their series, but their subsoil is thinner over the sandy and gravelly substratum.

Included in mapping are a few seep spots that are mostly along the lower foot slopes.

This mapping unit is suited to pasture and trees, and is an excellent source of gravel. The less sloping areas are suited to hay crops.

Runoff is very rapid; hence little water is stored

for plants. Operating farm equipment is difficult and hazardous. Because of the hazard of erosion and the difficulty in working these soils, sod crops are more practical to grow than row crops. Many pastures are productive in spring and in fall but are droughty in midsummer. Slopes limit most nonfarm uses. Capability subclass IVe; Howard part in woodland subclass 2r; Alton part in woodland subclass 3r.

HtE—Howard and Alton gravelly soils, 30 to 45 percent slopes. This undifferentiated group is on very steep terrace faces and valley sides. Areas consist either of Howard soils or Alton soils or some of both. They generally are very large; some are 100 acres or more in size. These soils have a profile similar to that described as representative of their series, but their subsoil is thinner over the sandy and gravelly substratum.

Included in mapping are a few slips and some seep spots that are mostly along the lower slopes or foot slopes.

This mapping unit is not suited to cultivated crops but is well suited to trees. It is a good source of gravel.

This soil is difficult to manage for pasture. The steep slopes make the use of farm equipment unsafe or impractical when liming, fertilizing, or mowing. Capability subclass VIIe; Howard part in woodland subclass 2r; Alton part in woodland subclass 3r.

Kanona Series

The Kanona series consists of deep, poorly drained and somewhat poorly drained soils that formed in glacial till that was derived mainly from shale. These soils are nearly level to moderately steep on uplands.

In a representative profile the surface layer is very dark gray friable silty clay loam about 8 inches thick. The subsurface layer is dark gray friable silty clay loam about 4 inches thick. The subsoil is mottled, strong brown firm shaly silty clay to a depth of 30 inches. The substratum, from a depth of 30 to 72 inches, is mottled, dark grayish brown firm shaly silty clay.

The available water capacity is moderate. Permeability is slow. A water table is near the surface for long periods. The root zone in most places extends to a depth of 12 inches. If the soils are not limed, the surface layer is slightly acid. Prolonged wetness and slow permeability are the principal limitations to farm and nonfarm uses.

Representative profile of Kanona silty clay loam, 6 to 20 percent slopes, in a pasture in the town of Canisteo, adjacent to McChesney Road about 1 mile east of Colonial Bills Creek:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium granular structure; friable; many roots; 10 percent coarse fragments; slightly acid; abrupt smooth boundary.

A2g—8 to 12 inches; dark gray (5Y 4/1) silty clay loam; moderate fine subangular blocky structure; friable; common roots; 5 percent coarse fragments; medium acid; clear wavy boundary.

B2g—12 to 30 inches; strong brown (7.5YR 5/8) shaly silty clay; few fine distinct reddish yellow (5YR 6/6) and gray (5Y 5/1) mottles; moderate medium angular blocky structure; firm; few roots; few fine pores; gray (5Y 5/1) coatings on ped surfaces; thin patchy clay films on vertical ped surfaces and in pores; 20 percent coarse fragments; medium acid; clear wavy boundary.

C—30 to 72 inches; dark grayish brown (2.5Y 4/2) shaly silty clay; common medium distinct strong brown (7.5YR 5/6) mottles; weak thick platy structure; firm; few fine pores; 20 percent coarse fragments; medium acid.

The solum is 20 to 36 inches thick. Reaction is medium acid or slightly acid in both the solum and the substratum. Coarse fragments make up 5 to 35 percent throughout.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 or 2.

The A2g horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 0 through 2. It ranges from heavy silt loam to silty clay loam.

The B horizon has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 2 through 8, and contains few to many distinct mottles. It ranges from shaly silty clay loam to silty clay.

The C horizon has hue of 10YR through 5Y, value of 3 through 5, and chroma of 1 through 4. It ranges from shaly silty clay loam to silty clay.

Kanona soils are near Fremont, Hornell, and Volusia soils. Kanona soils are finer textured than Fremont soils and are deeper to shale bedrock than are Hornell soils. They lack the fragipan layer of Volusia soils.

KaA—Kanona silty clay loam, 0 to 2 percent slopes. This nearly level soil is in depressions on the plateau summit. The areas are generally round or oblong and less than 10 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is generally black.

Included with this soil in mapping were small areas of Alden, Chippewa, and Tuller soils.

This soil is too wet for cultivation unless it is artificially drained. If it is drained, it is suited to corn, hay, and grain crops. In most areas there are excellent sites for ponds or for wetland wildlife habitat. Open ditch drainage is generally more effective than tile drainage because the soil is slowly permeable and has a high content of clay. Prolonged wetness is a limitation to nonfarm uses. Capability subclass IVw; woodland subclass 5w.

KaB—Kanona silty clay loam, 2 to 6 percent slopes. This gently sloping soil is on smooth side slopes that receive runoff from adjacent, more steeply sloping soils. The areas are 5 to 20 acres in size.

Included with this soil in mapping were small areas of Hornell and Volusia soils.

This soil is too wet for cultivation unless it is artificially drained. If drained, it is suited to corn, hay, and grain crops. Excellent sites for ponds are in the less sloping areas. Open ditch drainage is generally more effective than tile drainage because the soil is slowly permeable and has a high content of clay. Capability subclass IVw; woodland subclass 5w.

KaD—Kanona silty clay loam, 6 to 20 percent slopes. This sloping to moderately steep soil is on foot slopes below steeper soils where it accumulates substantial amounts of runoff. The areas consist of bands that are below and parallel to the steep side slopes and are 5 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Hornell and Volusia soils.

Under careful management that includes control of runoff and erosion, hay and grain crops can be

grown in the lesser sloping areas. Wetness and susceptibility to erosion are major limitations to farm uses. The high content of clay in the surface layer and subsoil, slope, and wetness are the main limitations for nonfarm uses. Capability subclass IVw; woodland subclass 5w.

Lackawanna Series

The Lackawanna series consists of deep, well drained soils that formed in glacial till that was derived mainly from reddish sandstone. These soils are gently sloping to moderately steep on uplands.

In a representative profile, in a cultivated area, the surface layer is dark brown channery silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches. In the upper 20 inches the subsoil is reddish brown channery silt loam, and in the lower part it is a very firm dense fragipan of dark reddish brown flaggy silt loam.

The available water capacity is moderate. In spring and in periods of heavy precipitation, the water table is perched above the slowly permeable dense fragipan for brief periods. The fragipan restricts the root zone to a depth of about 27 inches. If the soils are not limed, the surface layer is strongly acid or very strongly acid.

Representative profile of Lackawanna channery silt loam, 3 to 12 percent slopes, in a cultivated area in the town of West Union, just south of County Route 124 on Rose Hill about 2 miles south of Wileyville:

Ap—0 to 7 inches; dark brown (7.5YR 3/2) channery silt loam; weak medium and fine granular structure; very friable; many roots; 20 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21—7 to 21 inches; reddish brown (5YR 4/4) channery silt loam; weak fine and medium subangular blocky structure; friable; common roots; 20 percent coarse fragments; medium acid; clear wavy boundary.

B22—21 to 27 inches; reddish brown (5YR 4/4) channery silt loam; weak medium and coarse subangular blocky structure; firm; few roots; few fine pores; 20 percent coarse fragments; medium acid; clear wavy boundary.

Bx—27 to 60 inches; dark reddish brown (5YR 3/4) flaggy silt loam; moderate coarse prismatic structure that has prisms 4 to 8 inches across; reddish brown (5YR 5/3) silt coats around prisms; interior of prisms is massive; very firm and brittle; few roots along prism faces to depth of 30 inches; few fine pores; few patchy clay films along cleavage planes and in some pores; 30 percent coarse fragments; strongly acid.

Depth to bedrock is more than 60 inches. The solum is 40 to 60 inches thick. Depth to the Bx horizon ranges from 18 to 36 inches. Coarse fragments that are channery, flaggy, or stony make up 15 to 30 percent of the material above the fragipan and 20 to 35 percent of the fragipan. Reaction, if the soil is not limed, is very strongly acid or strongly acid above the fragipan and ranges from very strongly acid to medium acid in the fragipan and C horizon.

The Ap horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 or 3.

The B2 horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 or 5. It ranges from channery sandy loam to silt loam. In many places there is an A'2 horizon between the B2 and Bx horizons. The Bx horizon has hue of 5YR through 10R, value of 3 or 4, and chroma of 2 to 4. It ranges from channery sandy loam to flaggy silt loam.

The C horizon (not described in the representative profile) is similar to the Bx horizon in color and texture, but it is more massive.

Lackawanna soils are near Oquaga and Wellsboro soils. They are deeper to bedrock than Oquaga soils and are better drained than Wellsboro soils.

LaB—Lackawanna channery silt loam, 3 to 12 percent slopes. This gently sloping soil is on hill crests or upper valley sides where water does not accumulate. The areas conform in shape to the hill crests and generally range from 10 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of the moderately well drained Wellsboro soils in depressions and long drainageways and spots of Oquaga soil where the depth to rock is less than 40 inches.

The soil is suited to the crops commonly grown in the county, including cultivated crops, hay, pasture, and trees. The fragipan, however, restricts the root zone in places. Lime is needed for most crops, especially legumes. This soil should not be cultivated continuously because of the hazard of erosion. Contour tillage and stripcropping and diversions to break long slopes help control erosion and the loss of water. Crops that provide winter cover are helpful. Keeping tillage to a minimum and using crop residue also help control erosion. Slow permeability is a limitation to many nonfarm uses. Capability subclass IIe; woodland subclass 3o.

LaC—Lackawanna channery silt loam, 12 to 20 percent slopes. This sloping to moderately steep soil is on the upper side slopes of valley walls. Intermittent drainageways that run at right angles to the general contour dissect the areas, which generally range from 10 to 40 acres in size.

Included with this soil in mapping were small areas of moderately well drained Wellsboro soils and well drained Oquaga soils. Also included because of their small acreage were spots of steeper Lackawanna soils.

This soil is best suited to hay, pasture, or trees. The less sloping areas are suited to corn, if the soil is protected from erosion. The steeper areas are limited for crop production by slope and the hazard of erosion. The use of farm equipment is difficult and hazardous on this soil. Contour tillage, residue management, and reseeding in narrow strips help reduce erosion and aid in preserving moisture from summer rainfall. Slope is the major limitation to many nonfarm uses. Capability subclass IVe; woodland subclass 3r.

LC—Lackawanna-Wellsboro association, extremely stony. This gently sloping through moderately steep mapping unit is on hill crests and upper side slopes of valley walls. It is about 40 percent Lackawanna soils, 35 percent Wellsboro soils, and 25 percent Arnot, Oquaga, and Morris soils. Surface stones are numerous and are spaced about 3 to 5 feet apart. Stones about a foot in diameter are common throughout the profile. Slopes range from 2 to 30 percent. The areas range from 10 to 50 acres in size.

Included in mapping were small areas of Morris soils that are extremely stony.

This mapping unit is not suited to cultivated crops but is suited to woodland and wildlife habitat.

It is difficult to manage for pasture. The numerous surface stones prevent the use of farm equipment for

plowing, liming, or fertilizing. Extreme stoniness is the main limitation to both farm and nonfarm uses. Slope is a limitation in part of the area. Capability subclass VIIs; Lackawanna part in woodland subclass 3x; Wellsboro part in woodland subclass 2x.

Lordstown Series

The Lordstown series consists of moderately deep, well drained soils that formed in glacial till that is 20 to 40 inches thick over bedrock. These soils are on gently sloping to very steep bedrock-controlled ridges, hilltops, and steep valley sides.

In a representative profile, in a cultivated area, the surface layer is dark yellowish brown channery silt loam about 9 inches thick. The subsoil is friable very channery silt loam about 18 inches thick. In the upper 5 inches the subsoil is yellowish brown and in the lower 13 inches it is light olive brown. The underlying material is light olive brown firm very flaggy silt loam about 9 inches thick. At a depth of 36 inches it rests on fractured thin-bedded gray sandstone and siltstone bedrock.

The available water capacity is low to moderate. Permeability is moderate. The root zone is restricted to a depth of 20 to 40 inches above the bedrock.

Representative profile of Lordstown channery silt loam, 3 to 12 percent slopes, in a cultivated area in the town of Wheeler, adjacent to County Route 8 about 2 miles northwest of the hamlet of Wheeler:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) channery silt loam; moderate fine granular structure; friable; many fine roots; 30 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21—9 to 14 inches; yellowish brown (10YR 5/6) very channery silt loam; weak very fine subangular blocky structure; friable; common fine roots; 40 percent coarse fragments; very strongly acid; clear wavy boundary.

B22—14 to 27 inches; light olive brown (2.5Y 5/4) very channery silt loam; weak very fine subangular blocky structure; friable; few fine roots; few fine pores; few patchy clay films in pores; 50 percent coarse fragments; strongly acid; gradual wavy boundary.

C—27 to 36 inches; light olive brown (2.5Y 5/4) very flaggy silt loam; weak fine subangular blocky structure; firm; few fine pores that have few thin clay films; no roots; 60 percent coarse fragments; very strongly acid; abrupt wavy boundary.

IIR—36 inches; thin-bedded gray sandstone and siltstone bedrock; fractured.

Depth to bedrock ranges from 20 to 40 inches. The solum is 20 to 36 inches thick. Coarse fragments that are dominantly flat and angular make up 20 to 50 percent of the solum and 20 to 50 percent of the substratum. If the soils are not limed, reaction is very strongly acid or strongly acid in the solum and ranges from strongly acid to medium acid in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. It ranges from very channery silt loam to channery very fine sandy loam.

The C horizon has hue of 10YR through 5Y, value of 4 through 6, and chroma of 2 through 4. It ranges from very flaggy silt loam to channery fine sandy loam.

The R layer consists of massive thick to thin beds of siltstone or sandstone interbedded with shale. The bedrock is jointed and is commonly fractured at a depth of 3 to 6 feet.

These Lordstown soils differ from those in other areas by having 35 percent or more coarse fragments rather than less than 35 percent as defined in the Lordstown series. This, however, does not alter the use or behavior of the soils.

Lordstown soils are near Arnot, Bath, and Tuller soils. Lordstown soils are deeper to rock than both Arnot and Tuller soils and are better drained than Tuller soils. Lordstown soils are shallower to rock than Bath soils.

LoB—Lordstown channery silt loam, 3 to 12 percent slopes. This gently sloping and sloping soil is on slightly convex tops of hills and ridges in nearly all parts of the county. The areas conform to the shape of the hilltops and are 10 acres to several hundred acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were sizable areas of deeper Bath soils and shallow Arnot soils and small wet areas of shallow Tuller soils.

This soil is suited to cultivated crops, hay, pasture, and trees. Contour farming, minimum tillage, and the use of crop residue help reduce the loss of soil and water. Because this soil is in the highest elevated areas in the county, seed varieties should be selected that are suited to a shorter growing season. The restricted root zone is a slight limitation to farming. Depth to rock is a limitation to many nonfarm uses. Capability subclass IIe; woodland subclass 3o.

LoC—Lordstown channery silt loam, 12 to 20 percent slopes. This moderately steep soil is on long, narrow strips along the upper valley walls just below the crests of the hills. The areas are generally 10 to 50 acres in size.

Included with this soil in mapping were sizable areas of Bath and Arnot soils.

This soil is suited to hay, pasture, and trees. It tends to be droughty in summer. Slope, excessive runoff, and the hazard of erosion limit the use of this soil for crops. The use of farm equipment is difficult and hazardous on this soil. Contour tillage, residue management, and reseeding in narrow strips help reduce erosion and aid in preserving moisture from summer rainfall. Slope and depth to bedrock are the major limitations to nonfarm uses. Capability subclass IVe; woodland subclass 3r.

LRE—Lordstown-Arnot association, steep. This mapping unit is about 60 percent Lordstown soils, 20 percent Arnot soils, and 20 percent Bath, Lackawanna, and Oquaga soils. The soils are on valley walls throughout the county. They are 10 to 40 inches deep over bedrock. Ledges and outcrops of bedrock are common. Slopes range from 20 to 40 percent. The areas consist of bands along valley walls and range from 40 to 100 acres or more in size.

Included in mapping along Keuka Lake were areas of similar soils except that they were derived from shale and not from siltstone and sandstone. Also included were deep soils that formed in the flaggy talus material that collected at the foot of the steep slopes by gradually moving down the hillside.

This mapping unit is not suited to cultivation. It is better suited to permanent cover, and most of it is in trees. Many areas that have an excellent view of the valleys are used as sites for summer homes.

The steep slopes and the many rock outcrops prevent the use of farm machinery to improve pastures.

The hazard of erosion is severe if the soil is disturbed. Water runs off rapidly, and little water is received from other areas. Steep slopes, outcroppings, and shallowness are the major limitations to nonfarm uses. Capability subclass VIIs; Lordstown part in woodland subclass 3r; Arnot part in woodland subclass 4r.

LRF—Lordstown-Arnot association, very steep. This very steep mapping unit is mostly on forested slopes of the valley sides throughout the county. Ledges and outcrops of bedrock are common. The areas consist of bands along valley walls and are as large as several hundred acres. Slopes are generally more than 40 percent and in some places are nearly vertical.

These soils are too steep for use other than for trees, wildlife habitat, and some forms of recreation. Capability subclass VIIs; Lordstown part in woodland subclass 3r; Arnot part in woodland subclass 4r.

Madrid Series

The Madrid series consists of deep, well drained soils that formed in glacial till that was derived mainly from sandstone and limestone. These soils are on undulating to steep landforms on the sides of valleys.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsurface layer to a depth of 17 inches is leached pale brown fine sandy loam. The subsoil extends to a depth of 50 inches. In the upper 5 inches it is yellowish brown friable fine sandy loam; in the lower 28 inches it is brown firm gravelly fine sandy loam. The substratum from a depth of 50 to 64 inches is dark yellowish brown friable gravelly fine sandy loam.

The available water capacity is moderate. Permeability is moderate and moderately slow in the solum and moderately slow in the substratum. The root zone in most places extends to a depth of 30 inches, but it is not restricted to that depth. If the soil is not limed, the surface layer is medium acid.

Representative profile of Madrid fine sandy loam, undulating, in a cultivated area in the town of Wayland, just north of Genesee Expressway about 3/4 mile west of the hamlet of Perkinsville:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable; many roots; many fine pores; 10 percent coarse fragments; medium acid; abrupt smooth boundary.

A2—10 to 17 inches; pale brown (10YR 6/3) fine sandy loam; very weak fine subangular blocky structure; friable; common roots; many fine pores; 5 percent coarse fragments; medium acid; gradual smooth boundary.

B&A—17 to 22 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure with pale brown (10YR 6/3) coatings on ped surfaces; friable; few roots; common fine pores; 10 percent coarse fragments; medium acid; gradual smooth boundary.

B21t—22 to 33 inches; brown (10YR 5/3) gravelly fine sandy loam; weak medium subangular blocky structure; firm; few fine roots; common fine pores; clay linings in pores; patchy clay films on some ped faces; 20 percent coarse fragments; medium acid; gradual smooth boundary.

B22t—33 to 50 inches; brown (10YR 5/3) gravelly fine sandy loam; weak medium subangular blocky structure; firm; few fine roots; few fine pores with clay linings; thin clay films on some ped faces; 20 percent coarse fragments; slightly acid.

IIC—50 to 64 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam with lenses of sand; weakly stratified; massive; friable; few fine roots; few fine pores; 30 percent coarse fragments; slightly acid.

The solum is 36 to 60 inches thick. It ranges from strongly acid to slightly acid, and the substratum is slightly acid or neutral. Coarse fragments make up 5 to 15 percent of the A horizons and 10 to 30 percent of the B and C horizons.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. It is gravelly fine sandy loam, gravelly silt loam, and silt loam.

The C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. It ranges from gravelly fine sandy loam to silt loam. The till is either firm basal or water worked friable material.

Madrid soils are near Bath and Howard soils. They lack the fragipan in Bath soils and contain less coarse fragments than Howard soils.

MaB—Madrid fine sandy loam, undulating. This soil is on gently sloping convex knolls. The areas are circular and conform to the tops of the knolls; they are generally 10 to 30 acres in size. Slopes are short and range from 3 to 12 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping were small spots of Howard, Dunkirk, and Canaseraga soils and small areas of a similar soil except that it is sandy and has no coarse fragments.

This soil is suited to cultivated crops, hay, pasture, and trees. It is well suited to many nonfarm uses. Contour stripcropping, grassed waterways, and diversions help control erosion. Crops that provide a cover in winter help maintain the soil structure. Keeping tillage to a minimum on short complex slopes and using crop residue with no-plow tillage also help control erosion. Capability subclass IIe; woodland subclass 2o.

MaC—Madrid fine sandy loam, rolling. This soil is on the rolling part of valley sides. The areas conform to the steep sides of hummocks and knolls and are generally 5 to 10 acres in size. Slopes are short and complex, and they range from 12 to 20 percent.

Included with this soil in mapping were small areas of Howard, Dunkirk, and Canaseraga soils and a similar soil that has very few or no coarse fragments.

This soil is well suited to hay, pasture, and trees. It is less suited to row crops because of the complex slopes and the hazard of erosion.

Complex slopes make the use of farm equipment difficult and hazardous. If this soil is cultivated, a protective cover is needed for as long as possible. If row crops are grown, a cropping system to help protect the soil should include no-plow planting and should leave crop residue on the surface. Slope and susceptibility to erosion are the major limitations to nonfarm uses. Capability subclass IVe; woodland subclass 2r.

Mardin Series

The Mardin series consists of deep, moderately well drained soils that formed in glacial till that was derived mainly from sandstone and shale. These soils are

gently sloping to moderately steep on upland plateaus. They have a well expressed fragipan at a depth of 14 to 23 inches.

In a representative profile the surface layer is dark grayish brown channery silt loam about 9 inches thick. The subsoil is 51 inches thick. In the upper 6 inches it is yellowish brown friable channery silt loam; in the 4 inches below that it is mottled, pale brown friable channery silt loam. At a depth of 19 inches there is a dense fragipan. In the upper 10 inches the fragipan is mottled, brown to dark brown firm channery silt loam; in the lower 31 inches it is olive brown very firm very channery silt loam.

The available water capacity is low to moderate. Permeability is moderate above the fragipan and slow in and below the fragipan. In spring and in periods of heavy precipitation, the water table is perched above the dense fragipan. The root zone in most places is restricted by the fragipan. If the soils are not limed, the surface layer is very strongly acid to strongly acid.

Representative profile of Mardin channery silt loam, 8 to 15 percent slopes, in a pasture in the town of Wayland, adjacent to County Route 121, about ½ mile east of Loon Lake:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) channery silt loam; weak medium and fine granular structure; friable; many fine roots; 20 percent coarse fragments; medium acid; abrupt smooth boundary.

B21—9 to 15 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable; common fine roots; 20 percent coarse fragments; strongly acid; clear wavy boundary.

B22—15 to 19 inches; pale brown (10YR 6/3) channery silt loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; 20 percent coarse fragments; strongly acid; clear wavy boundary.

Bx1—19 to 29 inches; brown to dark brown (10YR 4/3) channery silt loam; many medium and coarse grayish brown and yellowish brown mottles; weak fine and medium subangular blocky structure; firm and brittle; few fine roots; few fine pores with few patchy clay films in pores, 25 percent coarse fragments; medium acid; abrupt irregular boundary.

Bx2—29 to 60 inches; olive brown (2.5Y 4/4) very channery silt loam; moderate very coarse prisms 12 to 18 inches across parting to weak coarse subangular blocky structure; prisms coated with silt streaks that have a gray (10YR 5/1) center and a brown to dark brown (7.5YR 4/4) border; very firm and brittle; few fine pores with patchy clay films in pores; 40 percent coarse fragments; medium acid.

Depth to bedrock is more than 60 inches. The solum is 40 to 70 inches thick. Depth to the Bx horizon ranges from 14 to 23 inches. Coarse fragments make up 10 to 25 percent of the material above the Bx horizon and 20 to 40 percent of the Bx and C horizons. Reaction ranges from very strongly acid to medium acid above the fragipan and from very strongly acid to neutral in the fragipan. It ranges from strongly acid to moderately alkaline in the C horizon.

The Ap horizon has a hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B2 horizon has hue of 7.5YR through 2.5Y, value of 4 to 6, and chroma of 3 through 6. It ranges from channery loam to silt loam.

The Bx horizon has hue of 10YR of 2.5Y, value of 3 to 5, and chroma of 3 or 4. It ranges from very channery loam to silt loam.

The C horizon has hue of 10YR through 5Y, value of 3 to 5, and chroma of 2 to 4. It is similar to the Bx horizon in texture.

Mardin soils are in a drainage sequence with well drained Bath soils, somewhat poorly drained Volusia soils, and poorly drained Chippewa soils.

MdB—Mardin channery silt loam, 2 to 8 percent slopes. This gently sloping soil is in high areas where little or no runoff accumulates. The areas are oval and are about 5 to 50 acres in size. This soil has a profile similar to the one described as representative of the series, but the mottling is closer to the surface.

Included with this soil in mapping were small areas of Bath, Volusia, Lordstown, and Canaseraga soils, soils that are nearly level, and a few spots of soils that are moderately sloping.

This soil is suited to cultivated crops, hay, pasture and trees. Because a slight wetness in spring can shorten the growing season, early maturing plant varieties are best. Contour tillage and stripcropping and diversion terraces are necessary if row crops are grown. Minimum tillage and management of crop residue help protect the surface layer from erosion. Random tile drainage in wet spots allows fields to be farmed uniformly. Seasonal wetness and slow permeability are limitations to nonfarm use. Capability subclass IIw; woodland subclass 3o.

MdC—Mardin channery silt loam, 8 to 15 percent slopes. This sloping soil is on the sides of large hills. The areas consist of strips that are roughly parallel to the contour of the hills. These areas generally are large; they are several hundred feet in width and 10 to 50 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Bath, Lordstown, and Volusia soils.

This soil is suited to corn, small grain, hay, pasture, and trees. Corn varieties that mature early and legumes that can tolerate wetness should be selected. Protection from loss of soil and water is essential for all crops. Diversions, contour strips, minimum tillage, and the return of crop residue are needed to help control erosion and maintain good soil structure. Slope, seasonal wetness, and slow permeability are limitations to nonfarm uses. Capability subclass IIIe; woodland subclass 3o.

MdD—Mardin channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on hillsides and narrow dissected valleys throughout much of the county. It is generally part of an overall long side slope. The areas are large; they range from 10 to 100 acres in size.

Included with this soil in mapping were small areas of Bath, Lordstown, Oquaga, Volusia, and Wellsboro soils.

This soil is suited to hay, pasture, and trees. Slope, excessive runoff, and the hazard of erosion limit the use of this soil for crops.

The use of farm equipment is difficult and hazardous on this soil, which tends to be droughty in midsummer. Contour tillage, residue management, and reseeding in narrow strips help reduce erosion and preserve moisture from summer rainfall. Slope and slow permeability are limitations to nonfarm uses. Capability subclass IVe; woodland subclass 3r.

MdD3—Mardin channery silt loam, 8 to 25 percent slopes, severely eroded. This sloping and moderately

steep soil is on long side slopes of large hills, mainly on the slopes along Keuka Lake, which is the main grape producing area. The areas are oblong in shape and are generally small; they are less than 5 acres in size. This soil has a profile similar to the one described as representative of the series, but erosion has removed much of the upper layers of soil and the fragipan is very close to the surface.

Included with this soil in mapping were small spots of Lordstown, Volusia, and uneroded areas of Mardin soils and many gullies.

Because this soil is near the lake, it is suited to grape production. Many areas that have an excellent view of Keuka Lake are used as homesites. The effect of the lake is such that it lengthens the growing season and lessens frost damage in spring and fall.

Erosion control and other management practices are needed to maintain optimum production. These practices include diverting excess water from vineyard areas, cross-slope planting, tile drainage, residue management, and mulching. Slope and slow permeability are limitations to nonfarm uses. Capability subclass VIe; woodland subclass 3r.

MhC3—Mardin-Ovid complex, 3 to 15 percent slopes, severely eroded. This gently sloping and sloping mapping unit is on the slopes above Keuka Lake and is part of an overall long side slope. The Mardin soil makes up about 60 percent of this complex. It has a profile similar to the one described as representative of its series, but the surface layer is channery silt loam. The Ovid soil makes up about 40 percent of the complex. It has a profile similar to the one described as representative of its series, but the surface layer is silt loam or silty clay loam. In each soil, because of erosion much of the upper part of the subsoil is part of the plow layer.

Included in mapping were a few areas where shallow gullies have cut into the underlying glacial till.

The soils are in an area climatically suited to grape production. Many areas of this soil that have an excellent view of Keuka Lake are used as homesites.

Erosion control and other management practices, including diverting excess water from vineyards, cross-slope planting, tile drainage, mulching, and residue management, are essential to help maintain the productivity of the vineyards. Slope, wetness, and slow permeability are limitations to nonfarm uses. Capability subclass IVe; Mardin part in woodland subclass 3o; Ovid part in woodland subclass 3w.

MnB—Mardin and Volusia channery silt loams, silty substratum, 2 to 6 percent slopes. These gently sloping soils are on foot slopes adjacent to streams that are below 1,600 feet in elevation; they are mainly in the Canisteo and Tioga river watersheds. Areas consist either of Mardin soils or Volusia soils or some of both. The areas are small; they are 5 to 10 acres in size. These soils have a profile similar to the one described as representative of their series, but they have a silty, stone-free layer in the substratum.

Included with this soil in mapping were small areas of Canaseraga and Wallington soils.

These soils are suited to cultivated crops, hay, pasture, and trees. They are best for short-season row crops that do not require early planting or late season harvesting. If these soils are used for row crops, measures are needed to control water runoff and soil loss. Contour tillage and stripcropping and diversion terraces help control erosion. Keeping tillage to a minimum, growing a winter cover crop, and returning crop residue to the soil help protect the surface layer.

These soils are susceptible to landslides. Many slides have occurred where streams have undercut the toe slopes. Seasonal wetness and slow permeability are limitations to nonfarm uses. Capability subclass IIw; Mardin part in woodland subclass 3o; Volusia part in woodland subclass 3w.

MnC—Mardin and Volusia channery silt loams, silty substratum, 6 to 12 percent slopes. These sloping soils are on foot slopes adjacent to streams that are below 1,600 feet in elevation; they are mainly in the Canisteo and Tioga river watersheds. Areas consist either of Mardin soils or Volusia soils or some of both. The areas are small; they are 5 to 20 acres in size. These soils have a profile similar to the one described as representative of their series, but they have a silty, stone-free layer in the substratum.

Included with these soils in mapping were small areas of Canaseraga soils and Wallington soils.

These soils are suited to cultivated crops, hay, pasture, and trees. They are best for crops that mature early and legumes that can tolerate some wetness. Measures are needed to help prevent soil and water loss for all crops. Diversions and contour stripcropping, keeping tillage to a minimum, and returning crop residue to the soil help reduce the hazard of erosion and maintain the soil structure. These soils are susceptible to landslides or down-slope slippage, especially when cuts are made into the toe slope. Capability subclass IIIe; Mardin part in woodland subclass 3o; Volusia part in woodland subclass 3w.

Middlebury Series

The Middlebury series consists of deep, moderately well drained and somewhat poorly drained soils that formed in alluvial sediment. These soils are nearly level and are on flood plains of rivers and smaller streams throughout the county. They are subject to periodic flooding.

In a representative profile the surface layer is silt loam about 12 inches thick. In the upper 5 inches it is very dark grayish brown, and in the lower 7 inches it is dark grayish brown. The subsoil is brown to dark brown friable silt loam about 10 inches thick. The substratum extends to a depth of 61 inches. In the upper 19 inches it is mottled, dark gray silt loam; in the lower 20 inches it is dark grayish brown very gravelly loamy sand.

The available water capacity is moderate to high. Permeability is moderate. In spring and in wet periods, a seasonal high water table is present. Floods occur during spring runoff and other periods of heavy rainfall, but excessive water seldom limits the use of these soils for farming. The water table controls the root zone, which in most places extends to a depth of 20 inches. Crops seldom show signs of a lack of mois-

ture in the growing season. If the soils are not limed, the surface layer is strongly acid or medium acid.

Representative profile of Middlebury silt loam, in a pasture, near U. S. Highway 15, about ½ mile south of the village of Avoca:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

A1—5 to 12 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; common, fine roots; slightly acid; gradual smooth boundary.

B2—12 to 22 inches; brown to dark brown (10YR 4/3) silt loam; few fine distinct gray (5Y 5/1) mottles; weak medium subangular blocky structure; friable; few roots; common coarse pores; medium acid; gradual smooth boundary.

C1g—22 to 41 inches; dark gray (10YR 4/1) silt loam; common medium distinct brown to dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; few roots; common fine pores; medium acid.

IIC2—41 to 61 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand; single grained; loose; 50 percent coarse fragments; medium acid.

The solum is 15 to 27 inches thick. Strongly contrasting gravelly or sandy material, which occurs only in some profiles, is deeper than 40 inches, but coarse fragments make up as much as 10 percent of the horizons above a depth of 40 inches. If the soils are not limed, reaction is strongly acid or medium acid in the surface layer and ranges from medium acid to slightly acid below the surface layer.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2.

The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It ranges from silt loam to fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It ranges from silt loam to fine sandy loam to a depth of 40 inches.

Middlebury soils are in a drainage sequence with well drained Tioga soils and poorly drained and very poorly drained Wayland soils.

Mp—Middlebury silt loam. This nearly level soil is in slight depressions on flood plains throughout the county. These areas are parallel to the streams and are subject to flooding mostly in spring. They are long and narrow and are 2 to 10 acres in size.

Included with this soil in mapping were areas of Wayland soils and small knolls of well drained Tioga soils. In the northwestern corner of the county, along Stony Brook and Canaseraga Creeks, soils are included that are similar but calcareous between depths of 20 and 40 inches. Also included along the Canisteo River and upper Cohocton River, are soils that are neutral in the surface layer and subsoil and along the Tioga River and Troops Creek, near the Pennsylvania state line, are small areas of Middlebury soils that have a sandy surface layer.

This soil is well suited to short season crops and annual forage crops. It is suited to most crops commonly grown in the county, including hay, pasture, and trees, but flooding early in spring and a seasonal high water table restrict the selection of crops.

This soil is easy to work. Selected perennial crops need to be tolerant of wetness for short periods in spring. Streambank protection is needed in places. Landscaping is needed in places to help surface drainage. Winter cover is desirable. Wetness and hazard of flooding are limitations to nonfarm uses. Capability subclass IIw; woodland subclass 2o.

Morris Series

The Morris series consists of deep, somewhat poorly drained soils that formed in dense glacial till that was derived mainly from red sandstone, siltstone, and shale. These soils are on uniform valley sides and broad divides on uplands in the southwestern part of the county.

In a representative profile the surface layer, in a wooded area, is dark reddish brown channery silt loam about 2 inches thick. The upper part of the subsoil is reddish brown channery silt loam about 10 inches thick. A subsurface layer of mottled, reddish gray channery silt loam about 3 inches thick separates the upper layer of subsoil and the underlying fragipan. The fragipan to a depth of 60 inches is mottled, dark reddish gray, firm channery loam.

The available water capacity is moderate. In spring and in wet periods, a seasonal high water table is perched on the slowly permeable fragipan layer. The root zone in most places is restricted to a depth of 10 to 20 inches above the fragipan. If the soils are not limed, the surface layer ranges from very strongly acid to medium acid.

Representative profile of Morris channery silt loam, 8 to 15 percent slopes, in a wooded area in the town of West Union, about 2 miles southeast of Wileysville and ½ mile north of the Pennsylvania state line:

A1—0 to 2 inches; dark reddish brown (5YR 2/2) channery silt loam; moderate fine granular structure; friable; 15 percent coarse fragments; very strongly acid; abrupt wavy boundary.

B2—2 to 12 inches; reddish brown (5YR 4/44) channery silt loam; moderate fine subangular blocky structure; very friable; 20 percent coarse fragments; strongly acid; clear wavy boundary.

A′2g—12 to 15 inches; reddish gray (5YR 5/2) channery silt loam; common medium distinct red (2.5YR 5/6) mottles; weak fine subangular blocky structure; friable; 25 percent coarse fragments; clear wavy boundary.

B′x—15 to 60 inches; dark reddish gray (5YR 4/2) channery loam; common medium distinct yellowish red (5YR 5/6) mottles; weak very coarse prismatic structure; massive in prism interiors; wedges of reddish gray (5YR 5/2) 4 to 6 inches apart extend into this horizon to a depth of 36 inches; firm; brittle; 25 percent coarse fragments; strongly acid.

Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 10 to 20 inches. Coarse fragments make up 15 to 35 percent, by volume, of the profile. Reaction ranges from medium acid to very strongly acid in the A and B2 horizons and the upper part of the fragipan and from strongly acid to slightly acid in the lower part of the fragipan and in the C horizon.

The Ap horizon has hue of 5YR or 7.5YR, value of 2 through 5, and chroma of 1 to 4.

The B2 horizon has hue of 2.5YR through 7.5YR, value of 3 to 5, and chroma of 2 through 4. The A′2 horizon has hue of 2.5YR through 7.5YR, value of 5, and chroma of 2 through 4.

The B′x horizon has hue of 5YR and 7.5YR, value of 4 or 5, and chroma of 2 through 4. The fragipan ranges from channery loam to silt loam.

Morris soils are in a drainage sequence with well drained Lackawanna soils and moderately well drained Wellsboro soils. Other associated soils are those of the Chippewa series. Morris soils are not as wet as Chippewa soils.

MrB—Morris channery silt loam, 2 to 8 percent slopes. This gently sloping soil is on broad upland saddles near the plateau summits. After heavy rains these areas are waterlogged above the fragipan. They receive large amounts of seepage water and runoff from nearby slightly higher landscapes. The areas are 20 to 100 acres in size.

Included with this soil in mapping were small areas of Wellsboro soils and Morris soils that are extremely stony.

This soil is suited to cultivated crops, hay, pasture, and trees. Unless the soil is artificially drained, wetness delays planting in spring and limits the choice of crops. If drainage is not practical, the soil is suited to water-tolerant forage crops.

Diversions help remove surface water from higher areas. Tile is suitable for random drainage of wet spots, but a complete drainage system needs some pattern of open drainage because of slow permeability and shallow depth to the fragipan. Returning crop residue to the soil and keeping tillage to a minimum help maintain soil structure. Wetness and slow permeability are limitations to many nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

MrC—Morris channery silt loam, 8 to 15 percent slopes. This sloping soil is in areas where surface water and subsurface seepage accumulate. In places it has shallow water courses that have not cut into the terrain. This soil is in areas that are 5 to 30 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of Wellsboro soils and Morris soils that are extremely stony.

This soil is suited to cultivated crops, hay, pasture, and trees. Because the soil is wet, much of it is still in forest or in idle brush cover; and because it remains wet and cold until late in spring, such crops as early maturing corn, water-tolerant legumes, and others that tolerate fairly poor drainage should be selected. Because of the shallow root zone, long summer dry spells affect plant growth.

Loss of soil and water can be reduced by using graded stripcropping and grassed waterways and by returning crop residue. Diversions are needed in places to break up long slopes and intercept water from adjacent areas. Slope, slow permeability, and wetness are limitations to many nonfarm uses. Capability subclass IIIe; woodland subclass 3w.

MSB—Morris extremely stony soils, gently sloping. This soil is on the foot slopes below steeper Wellsboro or Oquaga soils. It receives runoff from higher adjacent areas. Seep lines are common. The areas are oblong and are generally 5 to 20 acres in size. This soil has a profile similar to the one described as representative of the series, but it has more stones on the surface and throughout the soil and has a surface layer of loam or silt loam. The stones are spaced about 3 to 5 feet apart on the surface.

Included with this soil in mapping were small areas of Wellsboro soils that are extremely stony and spots of Chippewa soils and a few stony areas of Volusia and Chippewa soils in the southeastern part of the county.

Figure 8.—**Morris extremely stony soils, gently sloping.**

This soil is suited to pasture, trees, and wildlife habitat, and some areas are suited to native pasture. This soil is not suited to cultivated crops and is difficult to manage for pasture. The numerous surface stones prevent the use of farm equipment for plowing, liming, or fertilizing (fig. 8). Stoniness, seasonal wetness, and the slowly permeable fragipan are limitations to many nonfarm uses. Capability subclass VIIs; woodland subclass 3x.

Niagara Series

The Niagara series consists of deep, somewhat poorly drained soils that formed in silty lake-laid deposits. These soils are on gently sloping parts of lake plains.

In a representative profile the surface layer is dark grayish brown silt loam about 6 inches thick. Below this is a leached subsurface layer of mottled, grayish brown heavy silt loam about 10 inches thick. The subsoil is mottled, olive brown firm light silty clay loam to a depth of 36 inches. The upper part of the underlying material is dark grayish brown firm silt loam to a depth of 42 inches. The lower part to a depth of 60 inches is stratified layers of dark grayish brown silt and very fine sand.

The available water capacity is high. Permeability is moderately slow. Early in spring and in periods of heavy rainfall, a seasonal high water table is present. The root zone in most places extends to a depth of 24 inches.

Representative profile of Niagara silt loam, 2 to 6 percent slopes, in a cultivated field in the town of Wheeler, adjacent to County Route 13 about ½ mile east of State Route 53:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable;

many roots; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

A2—6 to 16 inches; grayish brown (10YR 5/2) heavy silt loam; common fine yellowish brown (10YR 5/8) mottles; strong medium to coarse subangular blocky structure; firm; few roots; 2 percent coarse fragments; strongly acid; clear wavy boundary.

B2t—16 to 36 inches; olive brown (2.5Y 4/4) light silty clay loam; common medium distinct yellowish brown (10YR 5/6) and olive gray (5Y 5/2) mottles; weak fine to medium angular blocky structure; firm; few roots; olive gray (5Y 5/2) clay films on peds common fine pores with clay linings; 2 percent coarse fragments; medium acid; gradual wavy boundary.

C1—36 to 42 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium platy structure; firm; few fine pores; neutral.

IIC2—42 to 60 inches; dark grayish brown (10YR 4/2) stratified layers of silt and very fine sand; firm; moderately alkaline; calcareous.

The solum is 28 to 40 inches thick. Reaction ranges from medium acid to mildly alkaline in the B horizon and in the upper part of the C horizon and ranges from neutral to moderately alkaline in the lower part of the C horizon. Carbonates are at a depth of 28 to 50 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It ranges from silt loam to light silty clay loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. It consists of stratified layers of silt and very fine sand.

Niagara soils are in a drainage sequence with well drained Dunkirk soils, moderately well drained Collamer soils, and poorly drained Canandaigua soils.

NgB—Niagara silt loam, 2 to 6 percent slopes. This gently sloping soil is on toe slopes adjacent to hummocks and knolls in areas of lake-laid sediments within valleys. The areas are only a few acres in size. Slopes are short.

Included with this soil in mapping were small spots of Collamer and Canandaigua soils.

If this soil is effectively drained, limed, and fertilized, it is suited to all crops commonly grown in the county, including hay, pasture, and trees. Undrained areas are better suited to forage crops that can tolerate wetness, such as birdsfoot trefoil and timothy.

Removal of excess water is needed if this soil is intensively cultivated. Tile and open-ditch drainage can be used, but careful design and installation are needed. Keeping tillage to a minimum and using a cropping system that includes an occasional sod or annual green manure crop help maintain soil structure. Slow permeability and seasonal wetness are the main limitations to many nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

Ochrepts and Orthents

OC—Ochrepts and Orthents. This soil unit consists of very steep areas that have been deeply dissected by streams. These tributary streams generally have steep slopes. Throughout much of the county they have cut through the soil material into the bedrock strata, as have the streams that drain areas adjacent to Keuka Lake. In these instances the slopes are nearly vertical and have large amounts of rock outcrop.

In other areas, such as the vicinity of Stony Brook State Park, the soil material is extremely thick. In these areas most slopes are very steep and have numerous slip scars. The soil material has a tendency to slip or slump downslope. The slippage is accelerated where streams undercut the deposit.

These areas should be maintained in their natural state as wildlife habitat and scenic areas. Capability subclass VIIIs; woodland subclass not assigned.

Oquaga Series

The Oquaga series consists of moderately deep, well drained soils that formed in glacial till that is 20 to 40 inches thick over the underlying reddish sandstone bedrock. These soils are on gently sloping to steep uplands in the southwestern part of the county.

In a representative profile the surface layer, in a wooded area, is black channery silt loam about 2 inches thick. It is underlain by a thin leached layer of reddish gray channery silt loam about 3 inches thick. The subsoil extends to a depth of 26 inches. In the upper 12 inches it is strong brown channery silt loam; in the lower 9 inches it is brown very channery silt loam. The substratum is brown to dark brown very channery silt loam that extends to a depth of 32 inches. Underlying this layer is sandstone and shale bedrock.

The available water capacity is low. Permeability is moderate. In spring, a seasonal high water table is present for very brief periods. The root zone is restricted to a depth of 20 to 40 inches. If the soils are not limed, the surface layer is very strongly acid.

Representative profile of Oquaga channery silt loam, 12 to 20 percent slopes, in a wooded area in the town of West Union, about ½ mile northeast of Rose School on County Route 124:

A1—0 to 2 inches; black (N 2/0) channery silt loam; moderate very fine granular structure; friable; many roots; 20 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—2 to 5 inches; reddish gray (5YR 5/2) channery silt loam; moderate very fine subangular blocky structure; friable; many fine roots; 20 percent coarse fragments; strongly acid; abrupt wavy boundary.

B21—5 to 17 inches; strong brown (7.5YR 5/6) channery silt loam; moderate fine subangular blocky structure; friable; common roots; 20 percent coarse fragments; strongly acid; clear wavy boundary.

B22—17 to 26 inches; brown (7.5YR 5/4) very channery silt loam; weak very fine subangular blocky structure; firm; few roots; 50 percent coarse fragments; strongly acid; clear wavy boundary.

C—26 to 32 inches; brown to dark brown (7.5YR 4/4) very channery silt loam; massive; firm; 65 percent coarse fragments; strongly acid; abrupt smooth boundary.

R—32 inches; sandstone and shale bedrock; commonly reddish but olive or gray in some places; somewhat shattered in the upper part.

Depth to bedrock ranges from 20 to 40 inches. Coarse fragments make up an average of 35 to 50 percent, by volume, of the material between the bedrock and the upper 10 inches of the surface, but in many places channery or flaggy fragments make up 60 to 90 percent, by volume, of a layer 4 to 12 inches thick just above the bedrock. Reaction is very strongly acid or strongly acid throughout.

The Ap horizon has hue of 5YR and 7.5YR, value of 3 and chroma of 2 through 4. The A1 horizon is either neutral

black or has hue of 5YR or 7.5YR, value of 2 to 5, and chroma of 2 to 4.

The B horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 through 6. It ranges from very channery loam to channery silt loam.

The C horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 2 through 4. It ranges from very channery fine sandy loam to channery silt loam, and in some profiles it has faint mottles where it comes in contact with the bedrock.

Oquaga soils are near Arnot and Lackawanna soils. They have a soil mantle that is thicker over rock than that of Arnot soils. They are shallower to rock than Lackawanna soils.

OgB—Oquaga channery silt loam, 3 to 12 percent slopes. This gently sloping and sloping soil is on slightly convex side slopes and consists of long narrow strips on hillsides. It receives very little runoff from other areas. This soil has cracks in the bedrock that allow water to drain freely through it. It has a profile similar to the one described as representative of the series, but it is generally under cultivation and has a plowed surface layer.

Included with this soil in mapping were small areas of stony Oquaga soils, Arnot soils, Wellsboro soils, and Morris soils.

This soil is well suited to crops commonly grown in the county, including hay, pasture, and trees, but the restricted root zone hinders crop growth in places. Lime is needed for most crops, especially legumes. In many areas the view enhances the value for use as homesites.

Contour tillage, stripcropping, diversions to break long slopes, and crops that provide winter cover help to control erosion and loss of water. Keeping tillage to a minimum and using crop residue also help control erosion. The depth to bedrock is the main limitation to many nonfarm uses. Capability subclass IIe; woodland subclass 3o.

OgC—Oquaga channery silt loam, 12 to 20 percent slopes. This sloping and moderately steep soil is on long narrow strips along the upper valley walls just below the crests of the hills. The areas are 10 to 50 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Lordstown, Mardin, Lackawanna, Wellsboro, and Arnot soils.

This soil is well suited to hay, pasture, and trees, but it is better suited to forage mixtures that include deep rooted plants. Row crops can be grown on the less sloping areas. Renovating and working the soil across the slope to protect it from soil and water loss are important in reseeding forage crops. Slope and shallowness to bedrock are the main limitations to many nonfarm uses. Capability subclass IVe; woodland subclass 3r.

OgD—Oquaga channery silt loam, 20 to 30 percent slopes. This steep soil is on valley sides in the southwestern part of the county. The areas consist of bands along the valley sides and continue in places for several thousand feet. The areas are large; they are generally between 50 and 100 acres in size.

Included with this soil in mapping were small areas of Arnot, Lordstown, Lackawanna, and Wellsboro soils.

This soil is suited to pasture and trees. Open areas are suitable for pasture, but cover vegetation needs to be maintained and grazing must be controlled to protect the soils from erosion. Many areas that have an excellent view are used for homesites.

This soil is too steep for safe use of farm machinery. Steep slopes and depth to bedrock are the major limitations to nonfarm use. Capability subclass VIe; woodland subclass 3r.

Ovid Series

The Ovid series consists of deep, moderately well drained and somewhat poorly drained soils that formed in glacial till that was mixed with lacustrine sediments. These soils are gently sloping and sloping and are on the lower side slopes of the plateau in the vicinity of Keuka Lake.

In a representative profile the surface layer is dark grayish brown silt loam about 9 inches thick. It is underlain by a thin leached subsurface layer of grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of 34 inches. In the upper 3 inches it is mottled, dark brown silt loam; in the lower 19 inches it is mottled brown to dark brown firm silty clay loam. The underlying material to a depth of 60 inches is mottled, reddish brown firm silty clay loam.

The available water capacity is moderate to high. A seasonal high water table is generally perched above the slowly permeable substratum. The root zone in most places extends to a depth of 20 inches. If the soils are not limed, the surface layer is medium acid.

Representative profile of Ovid silt loam, 2 to 6 percent slopes, in a cultivated area in the town of Wayne, adjacent to County Route 95 ½ mile south of State Route 54:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable; many roots; 5 percent coarse fragments; medium acid; abrupt smooth boundary.

A2—9 to 12 inches; grayish brown (10YR 5/2) silt loam; few fine faint brown to dark brown (10YR 4/3) mottles; moderate fine subangular blocky structure; common fine roots; few, fine pores; 2 percent coarse fragment; medium acid; clear wavy boundary.

B21—12 to 15 inches; brown to dark brown (7.5YR 4/4) heavy silt loam; common fine and medium distinct pinkish gray (7.5YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; few fine pores with patchy thin clay films on some ped faces; pinkish gray (7.5YR 6/2) ped faces and pore linings; 10 percent coarse fragments; slightly acid; clear wavy boundary.

B22t—15 to 34 inches; brown to dark brown (7.5YR 4/4) silty clay loam; common medium distinct light gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate coarse subangular blocky; firm; few fine roots along prism faces; common fine pores; pinkish gray (7.5YR 6/2) clay films on ped faces and pores; 10 percent coarse fragments; neutral; clear wavy boundary.

C—34 to 60 inches; reddish brown (5YR 4/3) silty clay loam; common medium distinct gray (N 5/0) mottles; weak thin and medium platy structure; firm; few pores; 10 percent coarse fragments; moderately alkaline; calcareous.

Depth to bedrock is more than 60 inches. The solum is 20 to 40 inches thick. Coarse fragments make up 1 to 25

percent of the solum and typically increase with depth. Carbonates are at a depth of 20 to 40 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2.

The A2 horizon has hue of 2.5YR through 10YR, value of 4 or 5, and chroma of 2 to 4. Reaction of the A horizons ranges from medium acid to neutral.

The B horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 3 or 4. It ranges from gravelly silt loam to silty clay loam and from medium acid to mildly alkaline. Ped faces have chroma of 1 or 2.

The C horizon is similar to the B horizon in color and texture, but it has a weak, platy structure, or it is massive. Reaction is mildly alkaline or moderately alkaline.

OvB—Ovid silt loam, 2 to 6 percent slopes. This gently sloping soil is in positions that correspond to levels of old glacial lakes along the east side of Keuka Lake. A major component of this soil is a reddish lake clay mixed with the local glacial till. The areas consist of bands that follow contours above the lake and are cut by intermittent drainageways, which run at right angles to the general contour. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Volusia, Mardin, and Tuller soils and a few small areas of deep, somewhat poorly drained, fine textured, reddish, stone-free soils in the vicinity of Keuka on the east side of Keuka Lake.

This soil is suited to cultivated crops, hay, pasture, and trees. Because of the location of this soil, it is used mainly for growing grapes.

The hazard of erosion is moderate. Contour planting, diversions, and grassed waterways should be used to control erosion. Winter cover crops protect the soil from erosion, improve tilth, and help maintain organic matter. Tile drainage improves trafficability, allows the soil to warm up earlier in spring, and provides a deeper rooting zone. Wetness, slow permeability, and the hazard of erosion are limitations to many nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

OvC—Ovid silt loam, 6 to 12 percent slopes. This sloping soil is in areas cut by intermittent drainageways. The areas are small; they are seldom as large as 10 acres in size. This soil has a profile similar to the one described as representative of the series, but the lighter colored horizon immediately below the plow layer has been destroyed by erosion and plowing.

Included with this soil in mapping were small areas of Volusia, Mardin, and Tuller soils and a few acres of deep, somewhat poorly drained, fine textured, reddish, stone-free soils in the vicinity of Keuka on the east side of Keuka Lake.

This soil is suited to cultivated crops, hay, pasture, and trees. The location of this soil favors the production of grapes.

The hazard of erosion is severe. Diversions, grassed waterways, and contour planting should be used to control erosion. Winter cover crops protect the soil from erosion, improve tilth, and help maintain organic matter. Tile drainage improves trafficability, allows the soil to warm up earlier in spring, and provides a deeper rooting zone. Wetness, slow permeability, and slope are limitations to many nonfarm uses. Capability subclass IIIe; woodland subclass 3w.

Palms Series

The Palms series consists of very poorly drained, well decomposed muck that formed mainly in herbaceous material that accumulated in basins or pot holes formerly occupied by shallow ponds and lakes. This muck is 16 to 50 inches thick and is underlain by loamy mineral layers. Slopes are less than 2 percent.

In a representative profile the surface layer is black muck about 10 inches thick. Below this is a layer of very dark brown muck to a depth of 16 inches. The next layer is a black muck that extends to a depth of 21 inches. The substratum between depths of 21 and 60 inches is dark gray silt loam.

The available water capacity is high. Permeability is rapid in the organic layers and moderate in the loamy material. The water table is near the surface for long periods and controls the root zone. If the areas are not limed, the surface layer is strongly acid.

Representative profile of Palms muck, in a swamp in the town of Wayland, about 1 mile southeast of the village of Wayland:

Oa1—0 to 10 inches; black (10YR 2/1) broken face; very dark brown (10YR 2/2) pressed, very dark gray (10YR 3/1) rubbed sapric material; 10 percent fiber; 5 percent fiber when rubbed; weak very fine subangular blocky structure; nonplastic and slightly sticky; few roots; 15 percent wood fragments; 10 percent mineral; neutral; clear boundary.

Oa2—10 to 16 inches; very dark brown (10YR 2/2) broken face; dark reddish brown (5YR 2/2) sapric material when pressed, black (5YR 2/1) when rubbed; 15 percent fiber; 2 percent fiber when rubbed; weak fine subangular blocky structure; slightly plastic and slightly sticky; few roots; 10 percent mineral; slightly acid; clear boundary.

Oa3—16 to 21 inches; black (5YR 2/1) broken face; pressed and rubbed sapric material; no fiber; moderate fine subangular blocky structure; slightly plastic and slightly sticky; few roots; 15 percent mineral; slightly acid; abrupt smooth boundary.

IIC—21 to 60 inches; dark gray (5Y 4/1) silt loam; massive; slightly plastic and slightly sticky; 5 percent pebbles; slightly acid.

Depth to bedrock is more than 5 feet. Depth to the loamy IIC horizon ranges from 16 to 50 inches. Fragments of twigs, branches, or logs, 1/8 inch to 6 inches in diameter, make up less than 15 percent of the volume of some profiles. The organic material ranges from strongly acid to slightly acid. The C horizon ranges from slightly acid to moderately alkaline.

The organic material has hue of 10YR to 5YR, value of 2 or 3, and chroma of 1 to 3. The organic material is mainly sapric, but in places it includes thin layers of hemic material.

The IIC horizon has hue of 10YR to 5Y, value of 4, and chroma of 1 or 2. It ranges from fine sandy loam to clay loam.

Palms soils are near Carlisle and Edwards soils. Palms soils lack the thick organic layer of Carlisle soils, and they are underlain by mineral material rather than by marl as are Edwards soils.

Pa—Palms muck. This level soil is in depressions of basins in which organic matter has accumulated. The areas are oblong and are 2 to 200 acres in size.

Included with this soil in mapping were small areas of Carlisle, Edwards, Warners, and Alden soils.

If this soil is adequately drained, it is suited to cultivated crops. In undrained areas it is suited to trees and makes excellent wetland wildlife habitat, and in most of the drained areas it is used for vegetable crops.

Maintaining the drainage system is the main management need. Drainage needs to be managed to keep water levels high enough to reduce the rate of subsidence. Large exposed areas need windbreaks to reduce soil blowing. Wetness, low strength, and compressibility severely limit nonfarm uses. Capability subclass IVw; woodland subclass 4w.

Red Hook Series

The Red Hook series consists of deep, somewhat poorly drained soils that formed in water deposited material that was derived mainly from sandstone and shale. These soils are in nearly level areas of glacial outwash terraces and older stream terraces.

In a representative profile the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 22 inches. In the upper 7 inches it is mottled brown to dark brown silt loam and loam. In the lower 9 inches it is mottled grayish brown loam. The underlying material to a depth of 60 inches is mottled grayish brown gravelly loam.

The available water capacity is moderate. Permeability is moderate in the solum and moderate to moderately slow in the substratum. A seasonal high water table is present. The root zone in most places extends to a depth of 20 to 24 inches. If the soils are not limed, the surface layer is medium acid.

Representative profile of Red Hook silt loam, in an idle brush area in the town of Hornby, about 1,000 feet south of State Route 414, at Ferenbaugh:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium subangular blocky structure; friable; many medium roots; 12 percent coarse fragments; medium acid; abrupt smooth boundary.

B21—6 to 8 inches; brown to dark brown (10YR 4/3) silt loam; few fine faint grayish brown (10YR 5/2) mottles; weak thin platy structure; friable; common fine roots; 10 percent coarse fragments; strongly acid; clear wavy boundary.

B22—8 to 13 inches; brown to dark brown (10YR 4/3) loam; many medium faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; friable; few fine roots; few fine pores; 10 percent coarse fragments; strongly acid; clear wavy boundary.

B23g—13 to 22 inches; grayish brown (10YR 5/2) loam; many medium distinct brown to dark brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; weak thin platy structure; friable; few fine roots; few fine pores; 10 percent coarse fragments; strongly acid; clear wavy boundary.

Cg—22 to 60 inches; grayish brown (10YR 5/2) gravelly loam; few medium distinct brownish yellow (10YR 6/6) and dark yellowish brown (10YR 4/4) mottles; weak fine to medium subangular blocky structure; firm; common medium pores; 30 percent coarse fragments; strongly acid.

Depth of bedrock is more than 5 feet. The solum is 20 to 40 inches thick. Reaction ranges from strongly acid to slightly acid in the A horizon and from strongly acid to neutral in the B and C horizons. Coarse fragments make up 5 to 35 percent of the soil.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 and 4, and chroma of 2.

The B horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 2 through 4. It ranges from gravelly loam to silt loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 1 to 3. It ranges from gravelly sandy loam to silt loam.

Red Hook soils are near Atherton and Braceville soils. They are better drained than Atherton soils, and they are wetter than Braceville soils.

Rh—Red Hook silt loam. This nearly level soil is in low, flat, or slightly concave positions on glacial outwash terraces. The areas are long and narrow and are 2 to 10 acres in size.

Included with this soil in mapping were small areas of Braceville, Atherton, Wallington, and Wayland soils.

If this soil is effectively drained, limed, and fertilized, it is suited to all crops commonly grown in the county, including hay, pasture, and trees. In undrained areas it is better suited to forage crops that can tolerate wetness, such as birdsfoot trefoil and timothy.

Excess water must be removed if this soil is intensively cultivated. Tile and open ditch drainage can be used for this purpose, but careful design and installation are needed. Returning crop residue, keeping tillage to a minimum, and growing sod crops and winter cover crops help maintain soil structure. Wetness is the main limitation to nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

Scio Series

The Scio series consists of deep, moderately well drained soils that formed in water-deposited silt and very fine sand. These soils are on nearly level stream terraces.

In a representative profile the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 35 inches. In the upper 13 inches it is mottled yellowish brown friable silt loam; in the lower 13 inches it is mottled brown friable very fine sandy loam. The upper part of the underlying material is dark grayish brown firm very fine sandy loam to a depth of 42 inches. The lower part to a depth of 60 inches is brown to dark brown loose very gravelly sand.

The available water capacity is high. Permeability is moderate above a depth of 40 inches and very rapid to slow below that depth. In spring and in other wet periods, a temporary high water table is present. The root zone in most places extends to a depth of 24 inches.

Representative profile of Scio silt loam in a cultivated area in the town of Erwin, 0.2 mile south of State Route 17, along the Addison-Erwin town line:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

B21—9 to 14 inches; yellowish brown (10YR 5/4) silt loam; few fine faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; weak coarse prisms parting to weak medium and fine subangular blocky structure; friable; common fine roots; few fine pores; medium acid; clear wavy boundary.

B22—14 to 22 inches; yellowish brown (10YR 5/4) silt loam; many medium and coarse distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak thick platy structure; friable; common fine roots; common fine pores; medium acid; clear wavy boundary.

B23—22 to 35 inches; brown (10YR 5/3) very fine sandy loam; common medium distinct light brownish gray (2.5Y 6/2) and strong brown (7.5YR 5/6)

mottles; massive; friable; few fine roots; common fine pores; medium acid; gradual wavy boundary.

C1—35 to 42 inches; dark grayish brown (10YR 4/2) very fine sandy loam; brown (10YR 5/3) coatings along cleavage planes; weak thick platy structure; firm; few fine roots; common fine pores; 5 percent coarse fragments; strongly acid; clear wavy boundary.

IIC2—42 to 60 inches; brown to dark brown (7.5YR 4/2) very gravelly sand with a few erratic small bodies of sticky sandy clay loam; single grained; loose; few fine roots; 60 percent coarse fragments; slightly acid.

The solum is 20 to 36 inches thick. It is very strongly acid to medium acid, and the substratum is strongly acid to mildly alkaline. Coarse fragments make up as much as 5 percent of the material above a depth of 40 inches and 5 to 60 percent of the material below that depth.

The Ap horizon has hue of 10YR, value of 3 and 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 through 6. It is silt loam or very fine sandy loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It ranges from very fine sandy loam to silt loam above a depth of 40 inches. Below that depth it ranges from silt loam to stratified sand and gravel.

Scio soils are in a drainage sequence with well drained Unadilla soils and somewhat poorly drained Wallington soils.

Sc—Scio silt loam. This nearly level soil is on old stream terraces. The areas are long and narrow and are mostly less than 5 acres in size.

Included with this soil in mapping were small areas of Unadilla, Middlebury, and Wallington soils, a similar soil that has a gravelly or sandy substratum at a depth of less than 40 inches, and a similar soil that is neutral in reaction.

This soil is suited to most crops commonly grown in the county and is well suited to truck crops. It has few to no coarse fragments.

In places slight wetness delays planting in spring, but the soil is easy to work. Wet spots need to be drained so that fields can be used more uniformly. Returning crop residue and growing a sod crop in the cropping system help maintain soil structure. Seasonal wetness and rare flooding in a few areas are the main limitations to nonfarm use. Capability subclass IIw; woodland subclass 2o.

Tioga Series

The Tioga series consists of deep, well drained soils that formed in recent deposits of alluvium. These soils are on nearly level flood plains along major streams and tributaries throughout the county; they are subject to periodic flooding.

In a representative profile the surface layer is dark brown silt loam about 17 inches thick. The subsoil is brown to dark brown very friable silt loam about 11 inches thick. The substratum is dark yellowish brown friable silt loam to a depth of 60 inches.

The available water capacity is high. Permeability is moderate. In spring, a seasonal high water table is present in the substratum for brief periods. The root zone in most places extends to a depth of 24 inches, but it is not restricted to that depth.

Representative profile of Tioga silt loam, in a cultivated area in the town of Lindley, along the Tioga River, just east of the hamlet of Presho:

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam; moderate very fine granular structure; very friable; many roots; neutral; clear smooth boundary.

A11—10 to 13 inches; dark brown (10YR 3/3) silt loam; moderate thin platy structure; friable; common roots; slightly acid; clear smooth boundary.

A12—13 to 17 inches; dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; very friable; common roots; strongly acid; clear abrupt boundary.

B—17 to 28 inches; brown to dark brown (10YR 4/3, 3/3) silt loam; weak fine subangular blocky structure; very friable; few roots; medium acid; gradual wavy boundary.

C—28 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; few roots; slightly acid.

The solum is 20 to 30 inches thick. Depth to gravelly layers is more than 40 inches. In most profiles there are few or no coarse fragments between depths of 10 and 40 inches. Reaction is strongly acid to slightly acid to a depth of 20 inches and is medium acid to neutral below that depth.

The A1 and Ap horizons have hue of 2.5Y or 10YR, value of 3 to 5, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It ranges from fine sandy loam to silt loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It ranges from fine sandy loam to silt loam to a depth of 40 inches, but below that depth it is stratified sand and gravel in places.

Tioga soils are in a drainage sequence with moderately well drained and somewhat poorly drained Middlebury soils and very poorly drained and poorly drained Wayland soils.

Tg—Tioga silt loam. This is a nearly level soil on flood plains throughout the county and is subject to occasional overflow.

Included with this soil in mapping were gravel bars and small areas of Middlebury soils. In the northwestern part of the county, along the Stony Brook and Canaseraga Creeks, areas of soils were included that have free carbonates at a depth of 20 to 40 inches; and along the Tioga River, Meade Creek, and Troups Creek were a few areas of soils that formed in alluvial deposits and that have a surface layer of fine sandy loam.

Tioga silt loam is one of the most productive soils in the county for cultivated crops. It is well suited to hay, pasture, and trees, and because it is near water it is well suited to irrigation. Row crops can be grown for several years if the content of organic matter is maintained, and if soil structure is preserved.

Minimum tillage and annual use of crop residue and cover crops, or at times growing of a sod crop, help maintain the content of organic matter and preserve soil structure. Although this soil is occasionally flooded early in spring, floodwater recedes rapidly and generally only 2 or 3 days are needed for the soil to dry before tillage. Control of streambank erosion and channel gouging is a problem along most streams. Flooding is the main limitation to nonfarm uses. Capability subclass IIw; woodland subclass 2o.

Tuller Series

The Tuller series consists of somewhat poorly drained and poorly drained soils that formed in a thin mantle of glacial till that is 10 to 20 inches thick over sandstone bedrock. These soils are nearly level to sloping and are in depressions or drainage saddles on uplands.

In a representative profile the surface layer is dark grayish brown channery silt loam about 6 inches thick. The subsoil is mottled, grayish brown very channery silt loam about 7 inches thick. At a depth of 13 inches the subsoil rests on horizontally bedded sandstone and siltstone rock.

The available water capacity is low. Permeability is slow. A seasonal high water table is perched above the bedrock. The root zone is restricted to depths above the bedrock, but a few roots penetrate the fissures in the bedrock.

Representative profile of Tuller channery silt loam, 0 to 6 percent slopes, in an old pasture lot in the town of Wayne, just east of County Route 94 about 1 mile south of junction of County Route 94 and State Route 54:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) channery silt loam; weak fine granular structure; friable; many roots; 35 percent coarse fragments; very strongly acid; abrupt smooth boundary.

B2g—6 to 13 inches; grayish brown (10YR 5/2) very channery silt loam; many medium distinct strong brown (7.5YR 5/8) mottles; moderate fine subangular blocky structure; firm; common roots; few fine pores; 40 percent coarse fragments; strongly acid; abrupt smooth boundary.

IIR—13 inches plus; dark grayish brown (10YR 4/2) fractured acid and sandstone and siltstone with gray silt loam in joints.

Depth to bedrock is 10 to 20 inches. The solum is 10 to 20 inches thick and ranges from very channery to channery silt loam. Coarse fragments that are dominantly flat make up 35 to 50 percent of the soil.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. If the soil is not limed, reaction is very strongly acid or strongly acid.

The B2 horizon has hue of 7.5YR through 2.5Y, value of 4 or 5, and chroma of 2 or 1. Reaction ranges from very strongly acid to medium acid. The underlying bedrock ranges from massive sandstone to interbedded sandstone, siltstone, and shale.

Tuller soils are near Arnot and Volusia soils. They are wetter than Arnot soils and are shallower over rock than Volusia soils.

TuB—Tuller channery silt loam, 0 to 6 percent slopes. This nearly level and gently sloping soil is in depressions and gently sloping areas that receive considerable amounts of runoff from higher adjacent areas. The depressions contain the poorly drained segment of Tuller soils. The rest of the areas are somewhat poorly drained. The areas commonly consist of bands several hundred feet in width that parallel the valley ridges; they are 5 to 40 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Arnot, Volusia, Chippewa, and Hornell soils. Also included because of its small acreage was a soil that has a heavier texture and is less than 20 inches thick over shale rock.

This soil is suited to hay, pasture, and trees, but it is better suited to grasses that are tolerant of wet, cold soils. It is not suited to early pasture.

Shallowness to bedrock and extreme wetness and dryness make this soil impractical to cultivate except for renovation of hay or pasture. Seasonal wetness and shallowness to bedrock are major limitations to nonfarm uses. Capability subclass IVw; woodland subclass 5w.

TuC—Tuller channery silt loam, 6 to 12 percent slopes. This sloping, somewhat poorly drained soil is on foot slopes immediately below steeper areas and receives considerable runoff and seepage from these higher areas. The areas of this soil consist of bands several hundred feet wide that are parallel to the valley ridges.

Included with this soil in mapping were small areas of Arnot, Mardin, Volusia, Hornell, and Chippewa soils.

This soil is best suited to hay, pasture, and trees. It is better suited to grasses that are tolerant of wet, cold soils. It is not suited to early pasture.

Shallowness to bedrock and extreme wetness and dryness make this soil impractical to cultivate except for the renovation of hay or pasture. Erosion is a hazard if this soil is tilled and not protected. The shallow depth to bedrock, wetness, and slope are limitations to nonfarm uses. Capability subclass IVw; woodland subclass 5w.

Unadilla Series

The Unadilla series consists of deep, well drained soils that formed in water-laid deposits of silt and very fine sand. These soils are on nearly level terraces in the valleys along rivers and major tributaries throughout the county.

In a representative profile the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 41 inches. In the upper 13 inches it is yellowish brown friable silt loam; in the lower 20 inches it is dark yellowish brown firm silt loam. The underlying material is dark brown loose very gravelly sandy loam to a depth of 60 inches.

The available water capacity is high. Permeability is moderate. The root zone extends to a depth of 40 inches or more. If the soils are not limed, the surface layer is strongly acid.

Representative profile of Unadilla silt loam, in a cultivated area in the town of Canisteo, adjacent to State Route 248 about 3 miles south of village of Canisteo:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; very friable; many fine coats; strongly acid; abrupt smooth boundary.

B21—8 to 21 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; many fine pores; medium acid; clear boundary.

B22—21 to 41 inches; dark yellowish brown (10YR 4/4) silt loam; weak very coarse subangular blocky structure; firm; common roots; many fine pores; medium acid; abrupt smooth boundary.

IIC—41 to 60 inches; dark brown (10YR 3/3) very gravelly sandy loam; single grained; loose; few roots; 45 percent coarse fragments; medium acid.

Depth to bedrock is more than 5 feet. The solum is 24 to 50 inches thick. It is typically free of coarse fragments, but it has erratic pebbles and thin layers of gravelly material or sand coarser than very fine sand in a few places. The stone-free silty mantle is commonly underlain by a IIC horizon of gravel or sand at a depth of 40 to 60 inches. Unless the soil is limed, reaction ranges from very strongly acid to medium acid in the solum and from strongly acid to slightly acid in the substratum.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4

or 5, and chroma of 3 to 6. It is silt loam or very fine sandy loam.

The C horizon is similar to the B horizon in color, but it is silt loam or very fine sandy loam above a depth of 40 inches and ranges from silt loam to very gravelly sand below that depth.

Unadilla soils are near Scio and Tioga soils. They are better drained than Scio soils and they contain more silt than Tioga soils.

Un—Unadilla silt loam. This nearly level soil is on terraces in the main valleys. The areas are long and narrow and conform to the shape of the valley floor; they are fairly large.

Included with this soil in mapping were small areas of well drained Tioga soils and moderately well drained Scio soils, small areas of similar soils that are neutral in the lower part of the subsoil, and spots where the stratified sand and gravel layer is at a depth of 24 to 40 inches.

This soil is suited to all crops grown in the county, including vegetables. Row crops can be grown for several consecutive years if the organic matter and soil structure are maintained. Much of this soil is already in residential or commercial use.

Annual use of crop residue and cover crops or the occasional growing of a sod crop help maintain the content of organic matter. Minimum tillage helps preserve soil structure. Where this soil is next to a large stream, it is subject to streambank erosion. This soil is excellent for most nonfarm uses, except for some areas that are flooded on rare occasions. Capability class I; woodland subclass 3o.

Volusia Series

The Volusia series consists of deep, somewhat poorly drained soils that formed in dense glacial till that was derived mainly from sandstone, siltstone, and shale. These soils have long uniform slopes that are on valley sides and broad divides on uplands. A well-defined fragipan at a depth of 10 to 20 inches greatly impedes rooting and the movement of water.

In a representative profile the surface layer is dark grayish brown channery silt loam about 7 inches thick. The upper part of the subsoil is mottled yellowish brown channery silt loam about 5 inches thick. A subsurface or leached layer of mottled gray channery silt loam about 3 inches thick separates the upper layer of subsoil and the fragipan. The underlying firm fragipan is channery silt loam about 31 inches thick; in the upper 16 inches it is brown and in the lower 15 inches it is dark grayish brown. The underlying material to a depth of 62 inches is olive firm channery loam.

The available water capacity is low to moderate. A seasonal high water table is generally perched above the very slowly permeable fragipan. If the soils are not limed, the surface layer is strongly acid. Seasonal wetness and the very slowly permeable fragipan are the main limitations to farm and nonfarm uses.

Representative profile of Volusia channery silt loam, 3 to 8 percent slopes, in a cultivated area in the town of Hornby, just east of County Route 41 about 3/4 mile south of hamlet of Hornby:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate very fine granular structure; very friable; 20 percent coarse fragments; strongly acid; abrupt smooth boundary.

B2—7 to 12 inches; yellowish brown (10YR 5/4) channery silt loam; few fine distinct gray (10YR 6/1) mottles; weak fine subangular blocky structure; friable; 15 percent coarse fragments; strongly acid; clear smooth boundary.

A'2g—12 to 15 inches; gray (10YR 6/1) channery silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; very weak fine subangular blocky structure; friable; common, fine roots; many fine pores; 15 percent coarse fragments; strongly acid; clear smooth boundary.

B'x1—15 to 31 inches; brown (10YR 5/3) channery silt loam; many medium distinct yellowish brown (10YR 5/8) mottles; strong very coarse prisms coated with gray (10YR 5/1) silt; massive within prisms; firm and brittle; 20 percent coarse fragments; strongly acid; gradual smooth boundary.

B'x2—31 to 46 inches; dark grayish brown (10YR 4/2) channery silt loam; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; massive; firm and brittle; 25 percent coarse fragments; strongly acid; gradual wavy boundary.

C—46 to 62 inches; olive (5Y 4/3) channery loam; massive; firm; slightly acid; 30 percent coarse fragments.

The solum is 40 to 60 inches thick. Depth to the fragipan ranges from 10 to 20 inches. Coarse fragments make up 10 to 30 percent of the solum and 15 to 60 percent of the C horizon. If the soil is not limed, reaction is very strongly acid or strongly acid above the fragipan and ranges from strongly acid to mildly alkaline in and below the fragipan.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3.

The B2 and Bx horizons have hue of 10 YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. They range from channery loam to light silty clay loam.

The C horizon is similar to the Bx horizon in color, but it ranges from very channery loam to channery silt loam.

Volusia soils are in a drainage sequence with well drained Bath soils, moderately well drained Mardin soils, and poorly drained Chippewa soils.

VoB—Volusia channery silt loam, 3 to 8 percent slopes. This soil is on undulating hilltops or uniformly gently sloping hillsides. The areas are generally oblong and are 10 to 40 acres or more in size. In many places this soil is adjacent to the higher lying Mardin soils and receives runoff from them. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Mardin and Chippewa soils.

This soil is suited to corn, oats, hay, and pasture if effective drainage is used. It remains cold and wet for long periods in spring; hence, it is not suited to early planting or grazing.

Tile drainage of low wet spots is beneficial. Graded stripcropping, diversions and grassed waterways, minimum tillage, and crop residue management help control erosion. Seasonal wetness and very slow permeability are limitations to many nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

VoC—Volusia channery silt loam, 8 to 15 percent slopes. This sloping soil is in long sloping areas where water accumulates from higher lying areas. The areas are generally 20 acres or more in size. This is the most extensive soil in the county.

Included with this soil in mapping were small areas of Mardin soils on knolls, small seepage spots of Chippewa soils along field drainageways, and small areas of Fremont and Morris soils.

This soil is suited to cultivated crops, hay, pasture, and trees. Crops that tolerate fairly poor drainage should be selected because the soil remains wet and cold until late in spring. Grazing early in spring is not feasible. In many areas the view adds to the potential for use as homesites.

Use of graded stripcropping and grassed waterways and returning crop residue help reduce the loss of soil and water. Drainage diversions are needed in places to break up long slopes and intercept water from adjacent areas. Tile drainage of wet spots is also desirable. Seasonal wetness, slope, and the very slow permeability are limitations to many nonfarm uses. Capability subclass IIIe; woodland subclass 3w.

VoD—Volusia channery silt loam, 15 to 25 percent slopes. This moderately steep soil is in areas along waterways on hillsides and foot slopes below areas of steeper, better drained soils. The areas generally consist of long narrow bands along the hillsides.

Included with this soil in mapping were small areas of eroded Volusia soils, small areas of Lordstown soils, Mardin soils on knolls, and small seep spots of poorly drained Chippewa soils.

This soil is suited to hay, pasture, and trees. It can be reforested and developed for recreation and wildlife.

Steep slopes restrict the use of this soil for crop production and make the use of farm machinery difficult and hazardous. The soil is wet, and it warms up late in spring. Minimum tillage is necessary to reestablish sod for hay or pasture. Steep slopes, seasonal wetness, and very slow permeability are limitations to most nonfarm uses. Capability subclass IVe; woodland subclass 3r.

Wallington Series

The Wallington series consists of deep, somewhat poorly drained soils that formed in wind- or water-deposited silt and very fine sand. These soils are on nearly level stream terraces, valley bottoms, and in depressions on uplands.

In a representative profile the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is mottled, brown silt loam about 9 inches thick. The subsoil is mottled, yellowish brown firm silt loam to a depth of 38 inches. The underlying material to a depth of 62 inches is strong brown and gray firm very fine sandy loam.

The available water capacity is moderate to high. A seasonal high water table is generally perched on the slowly permeable fragipan. The root zone in most places is restricted to depths above the fragipan. If the soils are not limed, the surface layer is strongly acid. Seasonal wetness and slow permeability are the main limitations to farm and nonfarm uses.

Representative profile of Wallington silt loam, in a forest in the town of Howard, about ½ mile south of Demons Pond:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine to medium granular structure; friable; many fine roots; medium acid; clear smooth boundary.

A2g—3 to 12 inches; brown (7.5YR 5/2) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; friable; many fine roots; strongly acid; clear wavy boundary.

Bxg—12 to 38 inches; yellowish brown (10YR 5/4) silt loam; many coarse distinct grayish brown (2.5Y 5/2) mottles; moderate very coarse prismatic structure; firm; brittle; few fine roots; few fine pores; prism coats are gray (10YR 6/1); strongly acid; gradual wavy boundary.

C—38 to 62 inches; 50 percent strong brown (7.5YR 5/6) and 50 percent gray (10YR 5/1) very fine sandy loam; massive; firm; slightly acid.

Depth to strongly contrasting layers and bedrock is more than 5 feet. The solum is 36 to 50 inches thick.

The Ap or A1 horizons have hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. Reaction ranges from very strongly acid to neutral.

The A2 horizon has hue of 7.5YR to 2.5Y, value of 5, and chroma of 2 or 1. It is silt loam or very fine sandy loam. Reaction ranges from very strongly acid to medium acid.

The Bx horizon has hue of 2.5Y to 7.5YR, value of 4 or 5, and chroma of 1 through 4. It is silt loam or very fine sandy loam. Reaction ranges from strongly acid to slightly acid.

The C horizon is similar to the Bx horizon in color. It has no structure and ranges from very fine sandy loam to stratified silt and very fine sand. Reaction ranges from medium acid to slightly acid.

Wallington soils are in a drainage sequence with well drained Unadilla soils and moderately well drained Scio soils.

Wa—Wallington silt loam. This is a nearly level soil in depressions on stream terraces, valley bottoms, and uplands.

Included with this soil in mapping, near Arkport, are small areas that have been covered with 4 to 6 inches of windblown muck, small areas that are underlain by gravel or till at a depth of 30 inches, and spots of Middlebury soils.

If this soil is artificially drained, it is suited to the crops commonly grown in the county. If this soil is undrained, it is limited to sod crops that tolerate wetness. Drainage is difficult in many areas because of the lack of suitable outlets. Seasonal wetness and slow permeability are limitations to many nonfarm uses. Capability subclass IIIw; woodland subclass 3w.

Warners Series

The Warners series consists of deep, very poorly drained soils that formed in 12 to 20 inches of mineral alluvial deposits that are underlain by marl. These soils are nearly level and are on flood plains.

In a representative profile the surface layer is silt loam about 13 inches thick. In the upper 10 inches it is very dark brown and in the lower 3 inches it is black and very sticky. The substratum to a depth of 60 inches is gray marl.

The available water capacity is moderate to high. Permeability is moderately slow to moderate. The water table is at or near the surface for long periods. If the soils are drained, the root zone extends to a depth of about 24 inches. If the soils are not limed, the surface layer is neutral. Wetness and the hazard of flooding are the principal limitations to farm and nonfarm uses.

Representative profile of Warners silt loam, in a cultivated area in the town of Wayland, just south of the Genesee Expressway about ¼ mile west of State Highway 21:

Ap—0 to 10 inches; very dark brown (10YR 2/2) silt loam; strong medium granular structure; friable; neutral; abrupt smooth boundary.

A1—10 to 13 inches; black (10YR 2/1) silt loam; weak medium subangular blocky structure; very sticky; mildly alkaline; abrupt wavy boundary.

IIC—13 to 60 inches; gray (5Y 5/1) marl; massive; friable; moderately alkaline; calcareous.

Depth to bedrock is more than 5 feet. Depth to marl or to friable material impregnated with carbonates ranges from 12 to 20 inches.

The A1 or Ap horizon has hue of 10YR, value of 2, and chroma of 1 or 2. Reaction ranges from slightly acid to mildly alkaline.

The C horizon has hue of 2.5Y or 10YR, value of 3 to 5, and chroma of 1 or 2. It ranges from loam to silty clay loam and is moderately alkaline and calcareous. Some profiles do not have a C horizon.

The IIC horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2. It is moderately alkaline calcareous marl.

Warners soils are near Canandaigua and Edwards soils. Warners soils formed in marl material, which is lacking in Canandaigua soils. Warners soils have a mineral surface layer and Edwards soils have an organic surface layer.

We—Warners silt loam. This is a nearly level soil in depressions on flood plains. It formed in alluvial deposits along streams that are charged with lime, which is precipitated out in the form of marl. In their natural condition these areas are ponded or have ground water within a few inches of the surface. The areas are generally round and are 10 to 40 acres in size.

Included with this soil in mapping were small areas of Edwards soils and Canandaigua soils.

This soil is used mainly for woodland or wildlife habitat. Wetness is the major limitation to farming because the soil lies in areas that are difficult to drain. Wetness and the hazard of flooding severely limit nonfarm uses. Capability subclass IIIw; woodland subclass 5w.

Wayland Series

The Wayland series consists of deep, very poorly drained and poorly drained silty soils that formed in alluvium that was derived mainly from slightly acid soil material. These soils are in level or depressed slack-water areas on flood plains and are subject to periodic flooding.

In a representative profile the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is mottled, grayish brown friable silt loam to a depth of 17 inches. From a depth of 17 to 31 inches the subsoil is gray silt loam that is distinctly mottled. From a depth of 31 to 47 inches the substratum is a light gray prominently mottled silt loam that is slightly acid. Below a depth of 47 inches the substratum is grayish colored stratified layers of silt and very fine sand.

The available water capacity is high. Permeability is slow in the solum and substratum. A water table that controls the root zone is at or near the surface for most of the year. If the soils are not limed, the surface layer is slightly acid.

Representative profile of Wayland silt loam, in a pasture in the town of Howard, adjacent to County Route 27, about 3 miles south of the hamlet of Howard:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; dark yellowish brown (10YR 3/4) root stains; weak fine subangular blocky structure; friable; many fine roots; no coarse fragments; medium acid; abrupt smooth boundary.

A2g—8 to 17 inches; grayish brown (10YR 5/2) silt loam; common medium distinct brown to dark brown (7.5YR 4/4) mottles; weak medium and fine subangular blocky structure; friable; common fine roots; few patchy clay films; no coarse fragments; slightly acid; clear wavy boundary.

B21g—17 to 25 inches; gray (10YR 5/1) silt loam; many coarse distinct yellowish brown (10YR 5/4) mottles; moderate coarse prismatic structure; firm; few fine roots; few fine pores; grayish brown (2.5Y 5/2) prism coats; no coarse fragments; medium acid; abrupt wavy boundary.

B22g—25 to 31 inches; gray (5Y 5/1) silt loam; many medium and coarse distinct brown to dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) mottles; strong coarse prismatic structure parting to moderate coarse subangular blocky; firm; few fine roots; common fine pores; no coarse fragments; slightly acid; abrupt wavy boundary.

C1g—31 to 47 inches; light gray (N 6/0) silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; massive; firm; few fine roots; few fine pores; no coarse fragments; slightly acid; abrupt smooth boundary.

IIC2g—47 to 60 inches; gray (N 5/0) silt and very fine sand; stratified; firm; slightly acid; occasional thin gravel strata.

Depth to contrasting gravelly or sandy material is more than 40 inches. Depth to rock is more than 5 feet. Reaction ranges from medium acid to mildly alkaline in the solum and the upper part of the substratum and from slightly acid to moderately alkaline in the lower part of the substratum.

The A1 and Ap horizons have hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2.

The B horizon has hue of 10YR through 5Y, value of 4 to 6, and chroma of 1 or 2. It ranges from silt loam to silty clay loam.

The C horizon is neutral, light gray or gray (N 6/0 or N 5/0), or it has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It ranges from silt loam to silty clay loam to a depth of 40 inches.

Wayland soils are in drainage sequence with well drained Tioga soils and moderately well drained and somewhat poorly drained Middlebury soils.

Wn—Wayland silt loam. This is a nearly level soil in low areas of flood plains along major rivers and streams. The areas are long and narrow and range from 5 to 100 acres in size.

Included with this soil in mapping were small areas of soils that formed in alluvial deposits that have layers of gravel within a depth of 40 inches. Also included were small spots of Middlebury, Palms, or Edwards soils, and an area in the vicinity of Arkport, of a mineral soil approximately 20 inches deep over muck.

If the soil is not drained, it is better suited to permanent pasture or trees. Some isolated areas can be drained and used for row crops, if suitable outlets are available. The dominant vegetation consists of water-tolerant grasses, sedges, and trees. Wetness and the hazard of flooding are the major limitations to farming and most nonfarm uses. Capability subclass IIIw; woodland subclass 4w.

Wellsboro Series

The Wellsboro series consists of deep, moderately well drained soils that formed in glacial till that was

derived from reddish sandstone, siltstone, and shale. These soils are on gently sloping to moderately steep uplands in the southwest corner of the county.

In a representative profile the surface layer is dark reddish brown channery silt loam about 7 inches thick. The upper part of the subsoil is mottled reddish brown channery silt loam about 9 inches thick. This is underlain by a leached subsurface layer of mottled, light reddish brown channery loam about 2 inches thick. The underlying fragipan is 42 inches thick; in the upper 12 inches it is reddish brown firm channery silt loam and in the lower 30 inches it is dark reddish brown very firm channery loam.

The available water capacity to a depth of 14 to 24 inches is low to moderate. In spring and in other wet periods, a temporary high water table is perched above the slowly permeable fragipan. The root zone extends to a depth of 14 to 24 inches. If the soils are not limed, the surface layer is very strongly acid. Seasonal wetness and slow permeability are the major considerations for most farm and nonfarm uses.

Representative profile of Wellsboro channery silt loam, 2 to 8 percent slopes, in a cultivated area in the town of West Union, along County Route 124, about 1/4 mile east of Rose School:

Ap—0 to 7 inches; dark reddish brown (5YR 3/3) channery silt loam; moderate fine and very fine granular structure; very friable; many roots; 20 percent coarse fragments; very strong acid; abrupt smooth boundary.

B2—7 to 16 inches; reddish brown (5YR 4/3) channery silt loam; few fine faint reddish brown (5YR 5/3) mottles; weak medium subangular blocky structure; friable; common roots; 20 percent coarse fragments; strongly acid; abrupt wavy boundary.

A'2—16 to 18 inches; light reddish brown (5YR 6/3) channery loam; common fine distinct reddish brown (5YR 5/4) and yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; friable; few roots; 15 percent, small coarse fragments; strongly acid; clear wavy boundary.

B'x1—18 to 30 inches; reddish brown (2.5YR 4/4) channery silt loam; moderate very coarse prisms 8 to 17 inches across parting to moderate medium subangular blocky structure; firm; brittle; reddish gray (5YR 5/2) streaks of silt ½ inch to 2 inches wide separate the prisms; prism faces are reddish brown (5YR 4/3); common fine pores with clay linings in some pores; 25 percent coarse fragments; very strongly acid; gradual wavy boundary.

B'x2—30 to 60 inches; dark reddish brown (5YR 3/3) channery loam; weak coarse angular blocky structure; very firm; brittle; gray streaks from above gradually disappearing; clay linings in some pores and on a few ped faces; 30 percent coarse fragments; very strongly acid.

Depth to bedrock is more than 60 inches. The solum is 40 to 70 inches thick. Depth to the fragipan ranges from 15 to 20 inches. Coarse fragments make up 15 to 30 percent of the material above the fragipan and 20 to 40 percent of the fragipan and C horizon. Reaction, if the soil is not limed, is very strongly acid to medium acid throughout the profile.

The Ap horizon has hue of 5YR to 10R, value of 3 or 4, and chroma of 2 or 3.

The B2 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 or 4. It ranges from channery loam to silt loam.

The Bx horizon has hue of 5YR or 2.5YR, value of 3 through 5, and chroma of 3 or 4. It is channery loam or channery silt loam.

The C horizon where present is similar to the Bx horizon, but it is massive in structure and less brittle in consistence.

Wellsboro soils are in a drainage sequence with well drained Lackawanna soils and somewhat poorly drained Morris soils. They are deeper to bedrock than Oquaga soils.

WoB—Wellsboro channery silt loam, 2 to 8 percent slopes. This gently sloping soil is on slightly convex, uniform side slopes on the plateau. It is gently undulating at the higher elevations. The areas are generally 5 to 20 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Morris soils and Wellsboro soils that have higher slopes and a few areas of the Lackawanna-Wellsboro soils that are extremely stony.

This soil is suited to cultivated crops, hay, pasture, and trees. Wetness in spring can shorten the growing season; hence, early maturing varieties of corn are best. Contour tillage, stripcropping, and diversions are necessary if row crops are grown. Minimum tillage and the return of crop residue help protect the surface layer from erosion. Seasonal wetness and the slowly permeable fragipan are the major soil features to consider for many nonfarm uses. Capability subclass IIw; woodland subclass 2o.

WoC—Wellsboro channery silt loam, 8 to 15 percent slopes. This sloping soil is on side slopes of the plateau in the southwestern part of the county. The areas are generally oblong in shape and 10 to 50 acres in size.

Included with this soil in mapping were small areas of Lackawanna and Morris soils; Lackawanna-Wellsboro soils, which are extremely stony; and small areas of Mardin and Volusia soils in places that are adjacent to this Wellsboro soil.

The soil is suited to cultivated crops, hay, pasture, and trees. Corn varieties that mature early and legumes that can tolerate wetness should be selected. The use of diversions, contour strips, minimum tillage, and the return of crop residue are needed to control erosion and maintain good soil structure. Seasonal wetness, slope, and a slowly permeable fragipan are the major considerations for nonfarm use. Capability subclass IIIe; woodland subclass 2o.

WoD—Wellsboro channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on hillsides or valley walls and consists of oblong units or bands several hundred feet in width and 10 to 40 acres in size.

Included with this soil in mapping were small areas of Lackawanna and Oquaga soils along slope crests, Morris soils generally along toe slopes, and some spots where the soil is eroded.

The soil is suited to hay, pasture, and trees. Slope, excessive runoff, and the hazard of erosion limit the use of this soil for crop production. The use of farm equipment is difficult and hazardous on this soil. Contour tillage, residue management, and reseeding in narrow strips help reduce erosion and help to preserve moisture from summer rainfall. Slope, a slowly permeable subsoil, and seasonal wetness are the major limitations to many nonfarm uses. Capability subclass IVe; woodland subclass 2r.

Use and Management of the Soils

This section discusses the general principles of management for agriculture that apply to all the soils used for farming in Steuben County. It explains the capability classification system, and gives estimated yields for crops under a high level of management. Also, it discusses the use of soils for woodland, for wildlife, for recreation, and in engineering.

General Principles of Soil Management [2]

Some principles of management apply to all the soils suitable for farm crops in the county. These general principles of management are discussed in the following paragraphs.

Most soils in the county need lime or fertilizer or both. The amounts needed depend on the natural content of lime and plant nutrients, which are determined by laboratory analyses of soil samples, on the needs of the crop, and on the level of yield desired. For assistance in getting tests made and interpreted, farmers and others should consult their Cooperative Extension Agent. The average content of organic matter is about 4 percent in the surface layer of soils in Steuben County. Nitrogen is released from organic matter, but most of it is in complex organic forms unusable by plants. Applying nitrogen fertilizer is necessary to supplement nitrogen made available from the soil. The soils are naturally low in phosphorus, and adding appropriate amounts of phosphate in the form of commercial fertilizers is essential for good crop yields. Most of the soils in Steuben County are low or medium in potassium. But some, for example, Ovid soils, that have accumulated clay in the subsoil are high in potassium.

Timely applications of nitrogen and phosphorus fertilizer is important. Nitrogen can be lost either through leaching in rapidly permeable soils, for example Alton soils, or by denitrification on the less permeable soils, for example Dunkirk soils. Small amounts of nitrogen applied at frequent or timely intervals, for example, a small amount applied at planting and the rest applied as a side-dressing for corn, generally give the best results.

New research findings are presented in current editions of "Cornell Recommends for Field Crops" and "Vegetable Production Recommendations" prepared by the staff of the New York College of Agriculture at Cornell University. In the absence of soil tests, those references together with this publication can be used as a guide in determining lime and fertilizer needs.

Most soils in Steuben County are fairly high in organic matter. It is important to maintain this high level for good soil tilth and fertility by regularly adding organic matter from animal manure, returning plant residues, sod crops, cover crops, and green manure crops.

Tillage reduces the content of organic matter and breaks down soil structure. Therefore, the soil should be tilled only to prepare the seedbed and to control weeds.

On wet soils, for example, Canandaigua silt loam, yields of cultivated crops can be increased by artificial drainage. Open ditches or tile drains can improve drainage. Tile drains cost more to install, but they generally require less maintenance, and fields are easier to farm because there are no open ditches. Drainage on sloping soils is more effective if the ditches or tile lines intercept the water as it moves horizontally down slope. If either tile or open ditches are used for drainage, suitable outlets are needed.

All soils are subject to erosion, which is a main source of sediment and is a major cause of pollution. Exposed surfaces following cultivation, especially on gentle or steeper sloping soils, greatly increase the potential for serious erosion. On erodible soils, for example, Collamer silt loam, rolling, a cropping system combined with other erosion control practices is needed to reduce runoff and erosion. A cropping system is the sequence of crops that are grown in combination with management that includes minimum tillage, mulch planting, use of crop residues, growing cover and green manure crops, and use of lime and fertilizer. Other useful practices that reduce erosion are contour cultivation, terracing, contour stripcropping, diversion of runoff, use of grassed waterways, and windbreaks to reduce wind erosion.

The effectiveness of a particular combination of practices differs from one soil to another, but different combinations can be equally effective on the same soil The local representative of the Soil Conservation Service is available to assist in planning an effective combination of practices to reduce erosion.

Pasture can effectively control erosion on most soils. High-level management is needed on some soils to insure enough ground cover to keep the soil from eroding. High-level management should include fertilization, grazing control, and careful selection of seeding mixtures. Grazing is controlled by rotating the livestock from pasture to pasture to allow the regrowth of plants. On some soils, pasture plants should be established that require the least amount of renovation to maintain good ground cover and produce adequate forage.

Capability classes and subclasses

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering purposes.

In the capability system, all kinds of soils are

[2] HAROLD L. HANSEN, conservation agronomist, Soil Conservation Service, helped prepare this section.

grouped at three levels; capability class, subclass, and unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial plants.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, range, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil mapping unit in the section "Description of the Soils."

The capability subclass is also identified in the "Guide to Mapping Units" at the back of this survey.

In this survey, use and management are discussed in the descriptions of mapping units in the section "Description of the Soils."

Yields per acre

The yields per acre that can be expected of the principal crops under a high level of management are shown in table 2. In any given year, yields can be higher or lower than those indicated in table 2 because of

TABLE 2.—*Estimated yields per acre of crops and pasture plants*

[Yields are for nonirrigated soils. All yields were estimated for a high level of management in 1973. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Beans, dry	Irish potatoes
	Bu	*Ton*	*Bu*	*Bu*	*Ton*	*Bu*	*Cwt*
Alden:							
Aa							
Alton:							
AlA	100	20	80	45	4.5	30	300
AlB	100	20	80	45	4.5	30	300
Arnot:							
ARC	60	12	50	35	2.0		
Atherton:							
At	75	15	60				
Bath:							
BaB	100	20	75	45	4.5	35	300
BaC	90	18	70	40	4.5		
BaD					4.0		
BBE							
Braceville:							
BrA	110	20	85	45	4.5	30	300
BrB	105	20	80	45	4.5	30	300
Canandaigua:							
Ca	90	17	65				
Canaseraga:							
CbB	90	18	70	40	4.0	35	300
CbC	85	17	65	40	4.0		
Carlisle:							
Cc							350

TABLE 2.—*Estimated yields per acre of crops and pasture plants*—Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Beans, dry	Irish potatoes
	Bu	*Ton*	*Bu*	*Bu*	*Ton*	*Bu*	*Cwt*
Chenango:							
Ch	100	20	80	45	5.0	35	300
Chippewa:							
Ck							
Collamer:							
CoC		20	75	50	4.5		
Dunkirk:							
DuC	100	20	95	55	5.0		
DuD					4.0		
Edwards:							
Ed							
Fluvaquents and Ochrepts:							
FL							
Fremont:							
FrB	85	17	65	35	3.0		240
Hornell:							
[1] HfB	85	17	65	35	3.0		
[1] HfC	75	15	65	35	3.0		
[1] HgD	60	12	60	30	3.0		
[1] HHE							
[1] HkD3							
Howard:							
HoA, HoB	100	20	80	45	4.5	35	300
HoC	80	16	65	35	4.0		
[1] HpD	75	15	60	35	4.0		
[1] HrB	100	20	80	45	4.5	35	300
[1] HrC	80	16	65	35	4.0		
[1] HrD					4.0		
[1] HtD					4.0		
[1] HtE							
Kanona:							
KaA, KaB	70	15	60				
KaD	75	12	55				
Lackawanna:							
LaB	100	20	75	45			300
LaC	90	18	70	40			
[1] LC:							
Lackawanna part							
Wellsboro part							
Lordstown:							
LoB	85	17	75	45	3.5		260
LoC	80	16	65	35	3.0		
[1] LRE:							
Lordstown part							
Arnot part							
[1] LRF:							
Lordstown part							
Arnot part							
Madrid:							
MaB	100	20	75	45	4.5	35	300
MaC	90	18	70	40	4.5		

TABLE 2.—*Estimated yields per acre of crops and pasture plants*—Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Beans, dry	Irish potatoes
	Bu	*Ton*	*Bu*	*Bu*	*Ton*	*Bu*	*Cwt*
Mardin:							
MdB	90	18	70	40	4.0	30	300
MdC	85	17	65	40	4.0		
MdD, MdD3	80	16	65	35	3.5		
[1] MhC3	80	16	65	35	3.5		
[1] MnB	85	17	65	35	3.5		
[1] MnC	70	14	60	30	3.0		
Middlebury:							
Mp	120	24	80	45	4.5	35	350
Morris:							
MrB	80	16	65	35	3.0		
MrC	70	14	60	30	3.0		
MSB							
Niagara:							
NgB	85	17	65	50	3.5		
Ochrepts and Orthents:							
OC							
Oquaga:							
OgB	85	17	75	45	3.5		260
OgC	80	16	65	35	3.0		
OgD							
Ovid:							
OvB	70	14	65	50	4.0		
OvC	65	13	60	40	3.5		
Palms:							
Pa							350
Red Hook:							
Rh	100	20	60		3.5		
Scio:							
Sc	110	22	85	45	4.5	35	300
Tioga:							
Tg	120	24	80	45	4.5	35	350
Tuller:							
TuB	70	14	60	35			
TuC	70	12	55	30			
Unadilla:							
Un	105	21	75	45	4.5	35	300
Volusia:							
VoB	80	16	65	35	3.0		
VoC	70	14	60	30	3.0		
VoD	65	13	60	30	2.5		
Wallington:							
Wa	90	18	70		3.5		
Warners:							
We	100	20	80				
Wayland:							
Wn	100	20					
Wellsboro:							
WoB	90	18	70	40	4.0		
WoC	85	17	65	40	4.0		
WoD	80	16	65	35	3.5		

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

seasonal variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used by many farmers in the county are assumed in estimating the yields. Hay and pasture yields are estimated for varieties of grasses and legumes suited to the soil. A few farmers may be obtaining average yields higher than those shown in table 2.

The management needed to achieve the indicated yields of the various crops depends upon the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the relative productive capacity of the soils for each of the principal crops. Yields are likely to increase in the future as new production technology is developed. The relative productivity of a given soil compared to other soils, however, is not likely to change.

Cultivated muck soils in the county are used principally for the production of potatoes shown in table 2 and onions and lettuce that are not shown in table 2. Estimated yields per acre on Carlisle muck are: onions, 800 to 1,000 bushels, and lettuce, 600 to 700 crates. Estimated yields per acre on Palms muck are: onions, 600 to 900 bushels, and lettuce, 500 to 600 crates.

Production of grapes is limited to areas where the climate is influenced by Keuba Lake. In such areas, excessive frost damage does not occur prior to maturity and harvesting of the grapes. Well managed areas of Mardin, Volusia, Ovid, and Lordstown soils can produce 7 tons of grapes per acre. In poorly managed areas the yield could be as low as 4 tons. Volusia and Ovid soils need an effective drainage system.

Woodland Management and Productivity [3]

Approximately 433,700 acres, or 48 percent, of Steuben County is classified as commercial forest land (*10*).

The areas of commercial forest-type groups in the county are as follows: white or red pine, 17,900 acres; plantations, 28,300 acres; oak, 43,700 acres; elm-ash-red maple, 72,300 acres; maple-beech-birch, 239,100 acres; and aspen-birch, 32,400 acres.

[3] By MEREDITH A. PETERS, woodland conservationist, Soil Conservation Service.

Table 3 is useful to woodland owners or forest managers who plan to use the soils for wood crops. Mapping unit symbols for those soils suitable for wood crops are listed alphabetically by soil name, and the ordination symbol for each soil is also included. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates no significant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the order in which the letters are listed above—x, w, t, d, c, s, f, and r.

In table 3 the soils are also rated for a number of factors to be considered in management. The ratings of slight, moderate, and severe are used to indicate the degree of major soil limitations.

Ratings of the hazard of erosion indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small; *moderate* if some measures are needed to control erosion during logging and road construction; and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of equipment limitation reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings when plant competition is not a limiting factor. The ratings are for seedlings from good planting stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of windthrow hazard are characteristics of the soil that affect the development of tree roots and the ability of soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

TABLE 3.—*Woodland management and productivity*

[Absence of an entry in a column means the information was not available]

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Alden: Aa	5w	Slight	Severe	Severe	Severe	Red maple	50	
Alton: AlA, AlB	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak	60 70	Eastern white pine, red pine, European larch.
Arnot: ARC	4d	Slight	Slight	Severe	Moderate	Northern red oak Sugar maple Eastern white pine White ash European larch	55	Eastern white pine, red pine, Scotch pine, European larch.
Atherton: At	4w	Slight	Severe	Severe	Severe	Eastern white pine Red maple	62 65	Northern white-cedar.
Bath: BaB	3o	Slight	Slight	Slight	Slight	Northern red oak Black cherry Sugar maple	61 75 70	Eastern white pine, red pine, Norway spruce, European larch.
BaC, BaD	3r	Slight	Moderate	Slight	Slight	Northern red oak Black cherry Sugar maple	61 75 70	Eastern white pine, red pine, Norway spruce, European larch.
BBE	3r	Moderate	Severe	Slight	Slight	Northern red oak Black cherry Sugar maple	61 75 70	Eastern white pine, red pine, Norway spruce, European larch.
Braceville: BrA, BrB	2o	Slight	Slight	Slight	Slight	Northern red oak White ash Sugar maple Black cherry Yellow-poplar	80 80 80 80 90	Yellow-poplar, European larch, Norway spruce, eastern white pine, black cherry.
Canandaigua: Ca	4w	Slight	Severe	Severe	Severe	Red maple Eastern white pine	65 65	Eastern white pine, white spruce.
Canaseraga: CbB	2o	Slight	Slight	Slight	Slight	Eastern white pine White ash Red pine White spruce Sugar maple	85 84 85 75 71	Sugar maple, red maple, American basswood, white oak, white ash, American beech, black cherry, eastern white pine.
CbC	2r	Moderate	Slight	Slight	Slight	Eastern white pine White ash Red pine White spruce Sugar maple	85 84 85 75 71	Sugar maple, red maple, American basswood, white oak, white ash, American beech, black cherry, eastern white pine.
Carlisle: Cc	5w	Slight	Severe	Severe	Severe	Red maple	46	
Chenango: Ch	3o	Slight	Slight	Slight	Slight	Sugar maple Red oak	65 70	Eastern white pine, Norway spruce.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Chippewa: Ck	5w	Slight	Severe	Severe	Severe	Red maple	50	Eastern white pine, white spruce.
Collamer: CoC	2r	Moderate	Slight	Slight	Slight	Sugar maple Black cherry White ash Eastern white pine	65 85	Eastern white pine, Norway spruce, European larch, Scotch pine.
Dunkirk: DuC	2r	Moderate	Slight	Slight	Slight	Eastern white pine Sugar maple American basswood White ash Black walnut Northern red oak Black cherry	85 65	Eastern white pine, Norway spruce, European larch, black walnut, Scotch pine.
DuD	2r	Severe	Moderate	Slight	Slight	Eastern white pine Sugar maple American basswood White ash Black walnut Northern red oak Black cherry	85 65	Eastern white pine, Norway spruce, European larch, black walnut.
Edwards: Ed	4w	Slight	Severe	Severe	Severe	Red maple	46	
Fluvaquents and Ochrepts: FL								
Fremont: FrB	3w	Slight	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
Hornell: [1] HfB: Hornell part	3w	Slight	Moderate	Slight	Slight	Sugar maple White ash Northern red oak	60 60 70	Eastern white pine, European larch, white spruce, Norway spruce.
Fremont part	3w	Slight	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
[1] HfC: Hornell part	3w	Moderate	Moderate	Slight	Slight	Sugar maple White ash Northern red oak	60 60 70	Eastern white pine, European larch, white spruce, Norway spruce.
Fremont part	3w	Moderate	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Hornell—Cont.:								
[1] HgD:								
Hornell part	3w	Severe	Moderate	Slight	Slight	Sugar maple White ash Northern red oak	60 60 70	Eastern white pine, European larch, white spruce, Norway spruce.
Fremont part	3r	Severe	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65 — — —	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
[1] HHE:								
Hornell part	3r	Severe	Severe	Slight	Slight	Sugar maple White ash Northern red oak	60 60 70	Eastern white pine, European larch, white spruce, Norway spruce.
Fremont part	3r	Severe	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65 — — —	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
[1] HkD3:								
Hornell part	3r	Severe	Moderate	Moderate	Moderate	Sugar maple White ash Northern red oak	60 60 70	Eastern white pine, European larch, white spruce, Norway spruce.
Fremont part	3r	Severe	Moderate	Moderate	Moderate	Sugar maple Northern red oak American basswood White ash Black cherry	65 65 — — —	Eastern white pine, European larch, Norway spruce, white spruce, Scotch pine, balsam fir, Douglas-fir.
Howard:								
HoA, HoB	2o	Slight	Slight	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70 — — — —	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
HoC	2r	Slight	Moderate	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70 85 — — —	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
[1] HpD:								
Howard part	2r	Slight	Moderate	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70 85 — — —	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Important trees	Site index	Trees to plant
Howard—Cont.:								
[1] HpD—Cont.:								
Dunkirk part	2r	Severe	Moderate	Slight	Slight	Eastern white pine Sugar maple American basswood White ash Black walnut Northern red oak Black cherry	65 65	Eastern white pine, Norway spruce, European larch, black walnut, Scotch pine.
[1] HrB:								
Howard part	2o	Slight	Slight	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70 85	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
Madrid part	2o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak White oak Yellow-poplar American basswood Eastern white pine Black cherry Black walnut	70 80	Eastern white pine, yellow-poplar, black walnut, black cherry, Norway spruce, white spruce, European larch, black locust.
[1] HrC, HrD:								
Howard part	2r	Slight	Moderate	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70 85	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
Madrid part	2r	Moderate	Moderate	Slight	Slight	Sugar maple Northern red oak Eastern white pine American basswood Black walnut	70 80	Douglas-fir, Scotch pine, balsam fir, European larch, eastern white pine.
[1] HtD:								
Howard part	2r	Slight	Moderate	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
Alton part	3r	Slight	Moderate	Slight	Slight	Sugar maple Northern red oak	60 70	Eastern white pine, red pine, European larch, Scotch pine.
[1] HtE:								
Howard part	2r	Moderate	Moderate	Slight	Slight	Sugar maple Eastern white pine White ash Basswood Black cherry	70	Eastern white pine, European larch, red pine, Douglas-fir, balsam fir, black locust, Scotch pine.
Alton part	3r	Moderate	Moderate	Slight	Slight	Sugar maple Northern red oak	60 70	Eastern white pine, red pine, European larch, Scotch pine.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Kanona: KaA, KaB	5w	Slight	Severe	Severe	Severe	Red maple Eastern white pine	50 	Eastern white pine, white spruce.
KaD	5w	Moderate	Severe	Severe	Severe	Red maple Eastern white pine	50 	Eastern white pine, white spruce.
Lackawanna: LaB	3o	Slight	Slight	Slight	Slight	Northern red oak Black cherry Sugar maple White ash	70 75 70 70	Eastern white pine, red pine, Norway spruce, European larch, Scotch pine.
LaC	3r	Slight	Moderate	Slight	Slight	Northern red oak Black cherry Sugar maple White ash	70 75 70 70	Eastern white pine, red pine, Norway spruce, European larch, Scotch pine.
[1] LC: Lackawanna part.	3x	Slight	Moderate	Slight	Slight	Northern red oak Black cherry Sugar maple White ash	70 75 70 70	Eastern white pine, red pine, Norway spruce, European larch, Scotch pine.
Wellsboro part	2x	Slight	Moderate	Slight	Slight	Northern red oak Sugar maple	78 70	European larch.
Lordstown: LoB	3o	Slight	Slight	Moderate	Slight	Sugar maple Black cherry Eastern white pine White ash	60 73 75 	Eastern white pine, European larch, black cherry, red pine, Norway spruce, Scotch pine.
LoC	3r	Slight	Moderate	Moderate	Slight	Sugar maple Black cherry Eastern white pine White ash	60 73 75 	Eastern white pine, European larch, black cherry, red pine, Norway spruce, Scotch pine.
[1] LRE: Lordstown part	3r	Slight	Moderate	Moderate	Slight	Sugar maple Black cherry Eastern white pine White ash	60 73 75 	Eastern white pine, European larch, black cherry, red pine, Norway spruce, Scotch pine.
Arnot part	4r	Slight	Moderate	Severe	Moderate	Northern red oak Sugar maple Eastern white pine White ash European larch	55 	Eastern white pine, red pine, Scotch pine, European larch.
[1] LRF: Lordstown part	3r	Moderate	Severe	Moderate	Slight	Sugar maple Black cherry Eastern white pine	60 73 	Eastern white pine, European larch, Black cherry, red pine, Norway spruce, Scotch pine.
Arnot part	4r	Moderate	Severe	Severe	Moderate	Northern red oak Sugar maple Eastern white pine White ash European larch	55 	Eastern white pine, red pine, Scotch pine, European larch.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Madrid:								
MaB	2o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak White oak Yellow-poplar American basswood Eastern white pine Black cherry Black walnut	70 80 	Eastern white pine, yellow-poplar, black walnut, black cherry, Norway spruce, white spruce, European larch, black locust, Scotch pine.
MaC	2r	Moderate	Moderate	Slight	Slight	Sugar maple Northern red oak Eastern white pine American basswood Black walnut	70 80 	Douglas-fir, Scotch pine, balsam fir, European larch, eastern white pine.
Mardin:								
MdB, MdC	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak Black cherry	60 63 75	Red pine, European larch, Norway spruce, eastern white pine, Scotch pine.
MdD, MdD3	3r	Slight	Moderate	Slight	Slight	Sugar maple Northern red oak Black cherry	60 63 75	Red pine, European larch, Norway spruce, eastern white pine, Scotch pine.
[1] MhC3:								
Mardin part	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak Black cherry	60 63 75	Red pine, European larch, Norway spruce, eastern white pine, Scotch pine.
Ovid part	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple Eastern white pine	70 60 70	Eastern white pine, white spruce, Norway spruce.
[1] MnB, MnC:								
Mardin part	3o	Slight	Slight	Slight	Slight	Sugar maple	60	Red pine, European larch, Scotch pine.
Volusia part	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple White ash	62 64 75	Eastern white pine, Norway spruce, European larch, white spruce, black cherry.
Middlebury:								
Mp	2o	Slight	Slight	Slight	Slight	Northern red oak Sugar maple	85 75	Eastern white pine, yellow-poplar, Norway spruce, European larch, black walnut, black cherry, Scotch pine.
Morris:								
MrB, MrC	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple Black cherry White ash	65 79 69 71	Eastern white pine, Norway spruce, white spruce, European larch.
MSB	3x	Slight	Moderate	Moderate	Moderate	White ash	71	European larch.
Niagara:								
NgB	3w	Slight	Moderate	Moderate	Moderate	Sugar maple	65	Eastern white pine, white spruce, Norway spruce.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Important trees	Site index	Trees to plant
Ochrepts and Orthents: OC								
Oquaga: OgB	3o	Slight	Slight	Slight	Slight	Sugar maple Northern red oak Black cherry Eastern white pine	69 71 72 75	Eastern white pine, red pine, European larch, Norway spruce, black cherry, Scotch pine.
OgC, OgD	3r	Slight	Moderate	Slight	Slight	Sugar maple Northern red oak Black cherry Eastern white pine	69 71 72 75	Eastern white pine, red pine, European larch, Norway spruce, black cherry, Scotch pine.
Ovid: OvB, OvC	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple Eastern white pine	70 60 70	Eastern white pine, white spruce, Norway spruce.
Palms: Pa	4w	Slight	Severe	Severe	Severe	Red maple	46	
Red Hook: Rh	3w	Slight	Moderate	Moderate	Moderate	Red maple Eastern white pine	65 65	Eastern white pine, Norway spruce.
Scio: Sc	2o	Slight	Slight	Slight	Slight	Sugar maple White ash Basswood Hemlock Eastern white pine	70 85	Eastern white pine, red pine, Scotch pine, Norway spruce, European larch.
Tioga: Tg	2o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Sugar maple	75 85 67	Eastern white pine, yellow-poplar, Norway spruce, black walnut, European larch, Scotch pine.
Tuller: TuB, TuC	5w	Slight	Severe	Severe	Severe	Red maple Eastern hemlock Eastern white pine	55	Eastern white pine, white spruce, Norway spruce.
Unadilla: Un	3o	Slight	Slight	Slight	Slight	Sugar maple Eastern white pine Northern red oak Black cherry White ash	65 75	Eastern white pine, Norway spruce, black cherry, European larch, red pine, white spruce, Scotch pine.
Volusia: VoB, VoC	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple White ash	62 64 75	Eastern white pine, Norway spruce, European larch, white spruce, black cherry.
VoD	3r	Moderate	Moderate	Moderate	Moderate	Northern red oak Sugar maple	70 60	Eastern white pine, Norway spruce, European larch, white spruce, black cherry.

TABLE 3.—*Woodland management and productivity*—Continued

Soil name and map symbol	Suitability group	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Important trees	Potential productivity: Site index	Trees to plant
Wallington: Wa	3w	Slight	Moderate	Moderate	Moderate	Northern red oak Sugar maple White ash	65 65 75	Eastern white pine, white spruce, Norway spruce.
Warners: We	5w	Slight	Severe	Severe	Severe	Red maple	55	
Wayland: Wn	4w	Slight	Severe	Severe	Severe	Red maple	65	
Wellsboro: Wob, WoC	2o	Slight	Slight	Slight	Slight	Northern red oak Sugar maple	78 70	Norway spruce, eastern white pine, red pine, black cherry, European larch, Scotch pine.
WoD	2r	Slight	Moderate	Slight	Slight	Northern red oak Sugar maple	78 70	Norway spruce, eastern white pine, red pine, black cherry, European larch, Scotch pine.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

The potential productivity of merchantable trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Site index can be converted into approximate growth and yield per acre that can be expected. For Steuben County, conversions of average site index into volumetric growth and yield are based on research as follows: White pine (*9*), upland oaks (*6*), and northern hardwoods (*8*). Table 4 gives yield per acre based on site index.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Wildlife Habitat [4]

Wildlife is an important natural resource in Steuben County. Steuben County has an excellent deer herd, and it is well populated with wild turkey, grouse, and rabbit. Pheasants are found mainly on the farmland in the valleys.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these

[4] ROBERT E. MEYERS, wildlife biologist, Soil Conservation Service, helped prepare this section.

TABLE 4.—*Woodland yields*

Forest species and production rating	Site index	Yield per acre (Even-aged, fully-stocked, natural stands): Age 60 (Cu ft)	Age 60 (Fbm [1])	Age 90 (Cu ft)	Age 90 (Fbm [1])
White pine [2]					
High	85–75	9,350	46,900	11,400	88,900
Moderately high	75–65	8,000	32,900	9,750	59,400
Moderate	65–55	6,850	23,100	8,300	41,700
Low	55–45	5,850	19,100	7,100	31,900
Upland oaks [3]					
High	85–75	3,700	18,600	5,200	30,950
Moderately high	75–65	3,100	13,900	4,400	24,500
Moderate	65–55	2,600	9,700	3,650	18,300
Low	55–45	2,050	5,600	2,700	12,600
Very low	45–35	1,550	2,700	2,170	7,600
Northern hardwoods [4]					
Moderately high	75–65	2,300	3,800	2,800	8,400
Moderate	65–55	2,100	([5])	2,500	5,500
Low	55–45	1,900	([5])	2,300	3,800

[1] Fbm = Foot board measure.

[2] Cubic-foot yields: Trees to a 3-inch top inside bark. Trees 3 inches in diameter and larger. Board-foot (Fbm) yields: International ¼-inch rule to a 6-inch top inside bark. Trees 9 inches in diameter and larger.

[3] Cubic-foot yields: Entire stem inside bark. Board-foot (Fbm) yields: International ⅛-inch rule to a 5-inch top, includng all trees with a 16-foot log.

[4] Cubic-foot yields: Trees 5 inches in diameter and larger. Board-foot (Fbm) yields: International ¼-inch rule. Trees 11 inches in diameter and larger.

[5] No measurable board-foot (Fbm) volume of trees 11 inches in diameter and larger.

elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 5 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Selecting areas that are suitable for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element

TABLE 5.—*Wildlife habitat*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Alden: Aa	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Alton: AlA, AlB	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Arnot: ARC	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Atherton: At	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Bath: BaB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BaC	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BaD	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BBE	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Braceville: BrA	Fair	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
BrB	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Canandaigua: Ca	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
Canaseraga: CbB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CbC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Carlisle: Cc	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Chenango: Ch	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Chippewa: Ck	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

TABLE 5.—*Wildlife habitat*—Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Collamer: CoC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Dunkirk: DuC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
DuD	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Edwards: Ed	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Fluvaquents and Ochrepts: FL										
Fremont: FrB	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Fair	Poor.
Hornell: [1] HfB: Hornell part	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fremont part	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Fair	Poor.
[1] HfC: Hornell part	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fremont part	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
[1] HgD: Hornell part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fremont part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
[1] HHE: Hornell part	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Fremont part	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
[1] HkD3: Hornell part	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Fremont part	Good	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Howard: HoA, HoB	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.
HoC	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
[1] HpD: Howard part	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
Dunkirk part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
[1] HrB: Howard part	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.

TABLE 5.—*Wildlife habitat*—Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Howard—Cont.:										
[1] HrB—Cont.:										
Madrid part	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
[1] HrC:										
Howard part	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
Madrid part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
[1] HrD:										
Howard part	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
Madrid part	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
[1] HtD:										
Howard part	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
Alton part	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
[1] HtE:										
Howard part	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Alton part	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Kanona:										
KaA	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
KaB	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
KaD	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Lackawanna:										
LaB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LaC	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
[1] LC:										
Lackawanna part.	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Wellsboro part	Very poor.	Very poor.	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Lordstown:										
LoB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LoC	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
[1] LRE:										
Lordstown part	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Arnot part	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
[1] LRF:										
Lordstown part	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Arnot part	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

TABLE 5.—*Wildlife habitat*—Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Madrid:										
MaB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaC	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Mardin:										
MdB	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
MdC	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
MdD, MdD3	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
[1] MhC3:										
Mardin part	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Ovid part	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
[1] MnB:										
Mardin part	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Volusia part	Fair	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
[1] MnC:										
Mardin part	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Volusia part	Fair	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Middlebury:										
Mp	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Morris:										
MrB	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
MrC	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
MSB	Very poor.	Very poor.	Good	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Niagara:										
NgB	Fair	Good	Good	Good	Good	Good	Very poor.	Good	Good	Poor.
Ochrepts and Orthents:										
OC										
Oquaga:										
OgB	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
OgC	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
OgD	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Ovid:										
OvB	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OvC	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 5.—*Wildlife habitat*—Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for—: Openland wildlife	Woodland wildlife	Wetland wildlife
Palms: Pa	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Red Hook: Rh	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Scio: Sc	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Tioga: Tg	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Tuller: TuB	Very poor.	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
TuC	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Unadilla: Un	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Volusia: VoB	Fair	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
VoC	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
VoD	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Wallington: Wa	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Warners: We	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wayland: Wn	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wellsboro: WoB	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
WoC	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
WoD	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, buckwheat, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and legumes that are planted for wildlife food and cover. Examples are fescue, bluegrass, reed canarygrass, switchgrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, wild carrot, goldenrod, ragweed, pigweed, pokeweed, dandelion, panicgrass, and quackgrass. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and the hazard of flooding. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples of native plants are oak, poplar, cherry, apple, hawthorn, dogwood, sumac, hickory, hazelnut, black walnut, blackberry, grape, blackhaw, viburnum, blueberry, bayberry, and briers. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are autumn-olive and crabapple. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Examples are pine, spruce, hemlock, fir, yew, cedar, and juniper. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, rushes, sedges, reeds, wildrice, cordgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of surface water that have an average depth of less than 5 feet and are useful to wildlife. They can be naturally wet areas, or they can be created by dams and levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and woodchuck.

Woodland habitat consists of hardwoods or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to this habitat are wild turkey, ruffed grouse, woodcock, thrushes, vireos, woodpeckers, tree squirrels, grey fox, raccoon, and deer.

Wetland habitat consists of water-tolerant plants in open, marshy, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Recreation

The soils of the survey area are rated in table 6 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 6 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, extensive maintenance, limited use, or by a combination of these measures.

The information in table 6 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing

roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet nor subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

Paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Engineering [5]

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 to 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential, residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (19) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 to 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability for each kind of soil as a source of construction material.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science than in engineering; the Glossary defines many of these terms.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads

[5] EDWARD A. FERNAU, senior soil engineer, New York State Department of Transportation, Soil Mechanics Bureau; and DONALD W. SHANKLIN, state conservation engineer, Soil Conservation Service, helped prepare this section.

TABLE 6.—*Recreational development*

["Depth to rock," and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Alden:				
Aa	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Alton:				
AlA	Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
AlB	Moderate: small stones	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
Arnot:				
ARC	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, depth to rock, small stones.	Moderate: small stones.
Atherton:				
At	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Bath:				
BaB	Moderate: percs slowly	Slight	Severe: slope	Slight.
BaC	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
BaD, BBE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Braceville:				
BrA, BrB	Moderate: percs slowly	Moderate: wetness	Severe: small stones	Moderate: wetness.
Canandaigua:				
Ca	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Canaseraga:				
CbB	Moderate: percs slowly	Slight	Moderate: slope, wetness, percs slowly.	Slight.
CbC	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope, percs slowly.	Slight.
Carlisle:				
Cc	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.	Severe: wetness, excess humus, floods.
Chenango:				
Ch	Moderate: floods	Slight	Severe: small stones	Slight.
Chippewa:				
Ck	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Collamer:				
CoC	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Dunkirk:				
DuC	Moderate: slope	Moderate: slope	Severe: slope	Slight.
DuD	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Edwards:				
Ed	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
Fluvaquents and Ochrepts:				
FL	Severe: floods	Severe: wetness	Severe: floods	Severe: wetness.
Fremont:				
FrB	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Hornell:				
[1] HfB:				
Hornell part	Moderate: wetness	Moderate: wetness	Severe: wetness, percs slowly.	Moderate: wetness, too clayey.
Fremont part	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
[1] HfC:				
Hornell part	Moderate: slope, wetness.	Moderate: wetness, slope.	Severe: slope	Moderate: wetness.
Fremont part	Moderate: wetness	Moderate: wetness, slope.	Severe: slope, wetness	Moderate: wetness.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hornell—Cont.:				
[1] HgD:				
Hornell part	Severe: slope	Severe: slope	Severe: slope	Moderate: wetness, slope.
Fremont part	Severe: slope	Severe: slope	Severe: slope, wetness	Moderate: wetness, slope.
[1] HHE:				
Hornell part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Fremont part	Severe: slope	Severe: slope	Severe: slope, wetness	Severe: slope.
[1] HkD3:				
Hornell part	Moderate: wetness, too clayey, slope.	Moderate: wetness, too clayey, slope.	Severe: slope	Moderate: wetness, too clayey.
Fremont part	Moderate: slope, wetness.	Moderate: wetness, slope.	Severe: slope, wetness	Moderate: wetness, too clayey.
Howard:				
HoA	Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.
HoB	Moderate: small stones	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
HoC	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
[1] HpD:				
Howard part	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
Dunkirk part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
[1] HrB:				
Howard part	Moderate: small stones	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
Madrid part	Slight	Slight	Moderate: slope	Slight.
[1] HrC:				
Howard part	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
Madrid part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
[1] HrD:				
Howard part	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
Madrid part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
[1] HtD:				
Howard part	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
Alton part	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: small stones.
[1] HtE:				
Howard part	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Alton part	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Kanona:				
KaA, KaB	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: wetness, to clayey.
KaD	Severe: slope, wetness	Severe: wetness, slope	Severe: wetness, slope.	Moderate: wetness, too clayey.
Lackawanna:				
LaB	Moderate: percs slowly	Slight	Severe: slope	Slight.
LaC	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
[1] LC:				
Lackawanna part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: large stones.
Wellsboro part	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: large stones.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lordstown:				
LoB	Moderate: small stones	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
LoC	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
[1] LRE:				
Lordstown part	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Arnot part	Severe: slope	Severe: slope	Severe: slope, depth to rock, small stones.	Severe: slope.
[1] LRF:				
Lordstown part	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Arnot part	Severe: slope	Severe: slope	Severe: slope, depth to rock, small stones.	Severe: slope.
Madrid:				
MaB	Slight	Slight	Moderate: slope	Slight.
MaC	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Mardin:				
MdB	Moderate: percs slowly	Moderate: small stones	Severe: small stones	Moderate: small stones.
MdC	Moderate: slope, percs slowly.	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
MdD, MdD3	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: small stones.
[1] MhC3:				
Mardin part	Moderate: slope, percs slowly.	Moderate: small stones	Severe: slope, small stones.	Moderate: small stones.
Ovid part	Moderate: wetness	Moderate: wetness	Severe: slope, wetness	Moderate: wetness.
[1] MnB:				
Mardin part	Moderate: percs slowly	Moderate: small stones	Severe: small stones	Moderate: small stones.
Volusia part	Moderate: wetness, percs slowly, small stones.	Moderate: wetness, small stones.	Severe: small stones	Moderate: wetness, small stones.
[1] MnC:				
Mardin part	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Volusia part	Moderate: wetness, percs slowly, small stones.	Moderate: wetness, small stones.	Severe: slope, small stones.	Moderate: wetness, small stones.
Middlebury:				
Mp	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Morris:				
MrB	Moderate: percs slowly, wetness.	Moderate: wetness	Severe: wetness	Moderate: wetness.
MrC	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness.	Severe: slope, wetness	Moderate: wetness.
MSB	Severe: large stones	Moderate: large stones, wetness.	Severe: large stones	Severe: large stones.
Niagara:				
NgB	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Ochrepts and Orthents:				
OC	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Oquaga:				
OgB	Moderate: small stones	Moderate: small stones	Severe: slope	Moderate: small stones.
OgC	Severe: slope	Severe: slope	Severe: slope	Moderate: small stones.
OgD	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Ovid:				
OvB	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
OvC	Moderate: wetness	Moderate: wetness	Severe: slope, wetness	Moderate: wetness.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Palms:				
Pa	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.	Severe: wetness, floods, excess humus.
Red Hook:				
Rh	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Scio:				
Sc	Slight	Slight	Moderate: wetness	Slight.
Tioga:				
Tg	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Tuller:				
TuB	Severe: wetness	Severe: wetness	Severe: depth to rock, wetness, small stones.	Severe: wetness.
TuC	Severe: wetness	Severe: wetness	Severe: slope, depth to rock, small stones.	Severe: wetness.
Unadilla:				
Un	Slight	Slight	Slight	Slight.
Volusia:				
VoB	Moderate: wetness, percs slowly.	Moderate: wetness	Severe: small stones	Moderate: wetness.
VoC	Moderate: wetness, percs slowly.	Moderate: wetness	Severe: slope	Moderate: wetness.
VoD	Severe: slope	Severe: slope	Severe: slope	Moderate: wetness.
Wallington:				
Wa	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness.
Warners:				
We	Severe: wetness, floods	Severe: wetness	Severe: wetness, floods	Severe: wetness.
Wayland:				
Wn	Severe: wetness, floods	Severe: wetness	Severe: wetness, floods	Severe: wetness.
Wellsboro:				
WoB	Moderate: percs slowly, small stones.	Slight	Severe: small stones	Slight: slope.
WoC	Moderate: slope, percs slowly, small stones.	Moderate: slope	Severe: slope, small stones.	Slight: slope.
WoD	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

and streets are indicated in table 7. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates

TABLE 7.—*Construction sites*

["Depth to rock" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Alden:					
Aa	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: wetness, frost action.	Severe: wetness, frost action.
Alton:					
AlA	Severe: small stones.	Slight	Slight	Slight	Slight.
AlB	Severe: small stones.	Slight	Slight	Moderate: slope	Slight.
Arnot:					
ARC	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Atherton:					
At	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: wetness, frost action.	Severe: wetness, frost action.
Bath:					
BaB	Slight	Moderate: frost action.	Slight	Moderate: frost action.	Moderate: frost action.
BaC, BaD, BBE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Braceville:					
BrA, BrB	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness	Moderate: frost action.
Canandaigua:					
Ca	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Canaseraga:					
CbB	Moderate: wetness, small stones.	Moderate: wetness	Severe: wetness	Moderate: slope, wetness.	Severe: frost action.
CbC	Moderate: slope, small stones, wetness.	Moderate: slope, wetness.	Severe: wetness	Severe: slope, wetness.	Severe: frost action.
Carlisle:					
Cc	Severe: floods, wetness, cutbanks cave.	Severe: wetness, frost action, excess humus.	Severe: wetness, frost action, excess humus.	Severe: wetness, excess humus, frost action.	Severe: wetness, frost action, excess humus.
Chenango:					
Ch	Moderate: floods, wetness, small stones.	Severe: floods	Severe: floods, wetness.	Severe: floods	Moderate: floods.
Chippewa:					
Ck	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: wetness, frost action.	Severe: wetness, frost action.
Collamer:					
CoC	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Severe: frost action.
Dunkirk:					
DuC	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, low strength.
DuD	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Edwards:					
Ed	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.
Fluvaquents and Ochrepts:					
FL	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Fremont:					
FrB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.

TABLE 7.—*Construction sites*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hornell:					
[1] HfB:					
Hornell part	Severe: wetness, depth to rock.	Severe: wetness	Severe: wetness, depth to rock.	Severe: wetness	Severe: wetness, low strength.
Fremont part	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
[1] HfC:					
Hornell part	Severe: wetness, depth to rock.	Severe: wetness	Severe: wetness, depth to rock.	Severe: slope, wetness.	Severe: wetness, low strength.
Fremont part	Severe: wetness	Severe: wetness	Severe: wetness	Severe: slope	Severe: frost action.
[1] HgD:					
Hornell part	Severe: slope, wetness, depth to rock.	Severe: slope, wetness.	Severe: slope, wetness, depth to rock.	Severe: slope, wetness.	Severe: slope, wetness, low strength.
Fremont part	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, frost action.
[1] HHE:					
Hornell part	Severe: slope, wetness, depth to rock.	Severe: slope, wetness.	Severe: slope, wetness, depth to rock.	Severe: slope, wetness.	Severe: slope, wetness, low strength.
Fremont part	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, frost action.
[1] HkD3:					
Hornell part	Severe: wetness, depth to rock.	Severe: wetness	Severe: wetness, depth to rock.	Severe: slope, wetness.	Severe: wetness, low strength.
Fremont part	Severe: slope	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, frost action.
Howard:					
HoA	Severe: small stones, cutbanks cave.	Slight	Slight	Slight	Slight.
HoB	Severe: small stones, cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
HoC	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] HpD:					
Howard part	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Dunkirk part	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] HrB:					
Howard part	Severe: small stones, cutbanks cave.	Slight	Slight	Moderate: slope	Slight.
Madrid part	Moderate: small stones.	Slight	Slight	Moderate: slope	Slight.
[1] HrC:					
Howard part	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Madrid part	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] HrD:					
Howard part	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Madrid part	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 7.—*Construction sites*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Howard—Cont.:					
[1] HtD:					
Howard part	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Alton part	Severe: slope, small stones.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] HtE:					
Howard part	Severe: slope, small stones, cutbanks cave.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Alton part	Severe: slope, small stones.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Kanona:					
KaA, KaB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, frost action.
KaD	Severe: wetness	Severe: wetness	Severe: wetness	Severe: slope, wetness.	Severe: wetness, frost action.
Lackawanna:					
LaB	Slight	Moderate: frost action.	Slight	Moderate: frost action.	Moderate: frost action.
LaC	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] LC:					
Lackawanna part.	Severe: slope	Severe: slope, large stones.	Severe: slope, wetness, large stones.	Severe: slope, large stones.	Severe: slope.
Wellsboro part	Severe: slope, wetness.	Severe: slope, large stones.	Severe: slope, large stones, wetness.	Severe: slope, large stones.	Severe: slope.
Lordstown:					
LoB	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.
LoC	Severe: slope, depth to rock.	Severe: slope	Severe: slope, depth to rock.	Severe: slope	Severe: slope.
[1] LRE:					
Lordstown part	Severe: slope, depth to rock.	Severe: slope	Severe: slope, depth to rock.	Severe: slope	Severe: slope.
Arnot part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
[1] LRF:					
Lordstown part	Severe: slope, depth to rock.	Severe: slope	Severe: slope, depth to rock.	Severe: slope	Severe: slope.
Arnot part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Madrid:					
MaB	Moderate: small stones.	Slight	Slight	Moderate: slope	Slight.
MaC	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Mardin:					
MdB	Severe: wetness	Moderate: frost action.	Severe: wetness	Moderate: frost action.	Moderate: frost action.
MdC	Severe: wetness	Moderate: frost action.	Severe: wetness	Severe: slope	Moderate: frost action.
MdD, MdD3	Severe: slope, wetness.	Severe: slope	Severe: slope, wetness.	Severe: slope	Severe: slope.
[1] MhC3:					
Mardin part	Severe: wetness	Moderate: frost action.	Severe: wetness	Severe: slope	Moderate: frost action.

TABLE 7.—*Construction sites*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Mardin—Cont.:					
[1] MhC3—Cont.:					
Ovid part	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: slope, frost action.	Severe: frost action.
[1] MnB:					
Mardin part	Severe: wetness	Moderate: frost action, wetness.	Severe: wetness	Severe: low strength.	Moderate: frost action.
Volusia part	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness, low strength.	Severe: frost action.
[1] MnC:					
Mardin part	Severe: wetness	Severe: low strength.	Severe: wetness, low strength.	Severe: slope, low strength.	Severe: low strength.
Volusia part	Severe: wetness	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: slope, wetness, low strength.	Severe: low strength, frost action.
Middlebury:					
Mp	Severe: floods, wetness.	Severe: floods	Severe: floods	Severe: floods	Severe: floods, frost action.
Morris:					
MrB, MSB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
MrC	Severe: wetness	Severe: wetness	Severe: wetness	Severe: slope, wetness.	Severe: frost action.
Niagara:					
NgB	Severe: wetness	Moderate: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
Ochrepts and Orthents:					
OC	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Oquaga:					
OgB	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
OgC, OgD	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Ovid:					
OvB	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: wetness, frost action.	Severe: frost action.
OvC	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: slope, frost action.	Severe: frost action.
Palms:					
Pa	Severe: wetness, excess humus, cutbanks cave.	Severe: wetness, frost action, excess humus.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, frost action, low strength.
Red Hook:					
Rh	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
Scio:					
Sc	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness	Severe: frost action.
Tioga:					
Tg	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, frost action.
Tuller:					
TuB	Severe: depth to rock, wetness, small stones.	Severe: wetness, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness, depth to rock.	Severe: depth to rock, wetness.
TuC	Severe: depth to rock, wetness, small stones.	Severe: wetness, depth to rock.	Severe: wetness, depth to rock.	Severe: slope, wetness, depth to rock.	Severe: depth to rock, wetness.

TABLE 7.—*Construction sites*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Unadilla:					
Un	Slight	Slight	Slight	Slight	Moderate: low strength.
Volusia:					
VoB	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: frost action.
VoC	Severe: wetness	Severe: wetness	Severe: wetness	Severe: slope	Severe: frost action.
VoD	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope, frost action.
Wallington:					
Wa	Severe: wetness	Severe: wetness, frost action.	Severe: wetness	Severe: wetness, frost action.	Severe: frost action.
Warners:					
We	Severe: wetness, floods.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: wetness, floods, frost action.
Wayland:					
Wn	Severe: wetness, floods.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: wetness, floods, frost action.
Wellsboro:					
WoB	Severe: wetness	Moderate: wetness	Severe: wetness	Moderate: slope, wetness.	Moderate: frost action.
WoC	Severe: wetness	Moderate: slope, wetness.	Severe: wetness	Severe: slope	Moderate: frost action.
WoD	Severe: slope, wetness.	Severe: slope	Severe: slope, wetness.	Severe: slope	Severe: slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 8.—*Soil ratings for sanitary facilities*

[See text for definitions of "slight," "moderate," "severe," and other terms used to rate soils]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Sanitary landfill	Area sanitary landfill	Daily cover for sanitary landfills
Alden:					
Aa	Severe: wetness, percs slowly.	Slight	Severe: wetness	Severe: wetness	Poor: wetness.
Alton:					
AlA	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: small stones, thin layer.
AlB	Slight	Severe: slope, sleepage.	Severe: seepage	Severe: seepage	Fair: small stones, thin layer.
Arnot:					
ARC	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope	Severe: small stones, thin layer.
Atherton:					
At	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Poor: wetness.
Bath:					
BaB	Severe: percs slowly.	Severe: slope	Severe: depth to rock.	Slight	Fair: small stones.
BaC	Severe: slope, percs slowly.	Severe: slope	Severe: depth to rock.	Moderate: slope	Poor: slope.
BaD, BBE	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Severe: slope	Poor: slope.

TABLE 8.—*Soil ratings for sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Sanitary landfill	Area sanitary landfill	Daily cover for sanitary landfills
Braceville:					
BrA, BrB	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage	Fair: thin layer, small stones.
Canandaigua:					
Ca	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Canaseraga:					
CbB	Severe: percs slowly.	Moderate: small stones.	Slight	Slight	Fair: thin layer.
CbC	Severe: percs slowly.	Severe: slope, small stones.	Slight	Moderate: slope	Fair: thin layer.
Carlisle:					
Cc	Severe: floods, wetness.	Severe: wetness, excess humus, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, seepage.
Chenango:					
Ch	Moderate: floods	Severe: floods	Severe: seepage	Severe: seepage	Poor: small stones.
Chippewa:					
Ck	Severe: wetness, percs slowly.	Moderate: small stones.	Severe: wetness	Severe: wetness	Poor: wetness.
Collamer:					
CoC	Severe: percs slowly, wetness.	Severe: slope	Moderate: wetness	Moderate: slope	Fair: slope.
Dunkirk:					
DuC	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope	Fair: slope.
DuD	Severe: slope, percs slowly.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Edwards:					
Ed	Severe: floods, wetness.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, excess humus.	Severe: floods, wetness, seepage.	Poor: excess humus, wetness, hard to pack.
Fluvaquents and Ochrepts:					
FL	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods	Poor: wetness.
Fremont:					
FrB	Severe: percs slowly, wetness.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
Hornell:					
[1] HfB:					
Hornell part	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: wetness, depth to rock.	Moderate: wetness	Fair: thin layer.
Fremont part	Severe: percs slowly, wetness.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
[1] HfC:					
Hornell part	Severe: depth to rock, wetness, percs slowly.	Severe: slope, depth to rock, wetness.	Severe: wetness, depth to rock.	Moderate: wetness	Fair: slope, thin layer.
Fremont part	Severe: percs slowly, wetness.	Severe: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
[1] HgD:					
Hornell part	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock, wetness.	Severe: wetness, depth to rock.	Severe: slope	Poor: slope.
Fremont port	Severe: slope, percs slowly, wetness.	Severe: slope	Severe: wetness	Severe: slope	Poor: slope, small stones.
[1] HHE:					
Hornell part	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock, wetness.	Severe: slope, wetness, depth to rock.	Severe: slope	Poor: slope.

TABLE 8.—*Soil ratings for sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Sanitary landfill	Area sanitary landfill	Daily cover for sanitary landfills
Hornell—Cont.:					
[1] HHE—Cont.:					
Fremont part	Severe: slope, percs slowly, wetness.	Severe: slope	Severe: slope	Severe: slope	Poor: slope, small stones.
[1] HkD3:					
Hornell part	Severe: depth to rock, wetness, percs slowly.	Severe: slope, depth to rock, wetness.	Severe: wetness, depth to rock.	Severe: slope	Fair: slope, thin layer.
Fremont part	Severe: slope, percs slowly, wetness.	Severe: slope	Severe: wetness	Severe: slope	Poor: slope, small stones.
Howard:					
HoA	Slight	Severe: seepage	Severe: seepage	Severe: seepage	Fair: small stones, thin layer.
HoB	Slight	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: small stones, thin layer.
HoC	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
[1] HpD:					
Howard part	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Dunkirk part	Severe: slope, percs slowly.	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
[1] HrB:					
Howard part	Slight	Severe: slope, seepage.	Severe: seepage	Severe: seepage	Fair: small stones, thin layer.
Madrid part	Moderate: percs slowly.	Severe: slope	Slight	Slight	Fair: small stones.
[1] HrC:					
Howard part	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Madrid part	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
[1] HrD:					
Howard part	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Madrid part	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
[1] HtD:					
Howard part	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
Alton part	Severe: slope	Severe: slope, seepage.	Severe: seepage	Severe: slope, seepage.	Poor: slope.
[1] HtE:					
Howard part	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
Alton part	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
Kanona:					
KaA, KaB	Severe: wetness, percs slowly.	Moderate: seepage	Severe: wetness	Severe: wetness	Fair: small stones.
KaD	Severe: wetness, percs slowly.	Severe: slope	Severe: wetness	Severe: wetness	Fair: slope, small stones.
Lackawanna:					
LaB	Severe: percs slowly.	Severe: slope	Slight	Slight	Fair: small stones.
LaC	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
[1] LC:					
Lackawanna part.	Severe: slope, percs slowly.	Severe: slope	Severe: large stones.	Severe: slope	Poor: slope, large stones.
Wellsboro part	Severe: slope, wetness, percs slowly.	Severe: slope	Severe: large stones.	Severe: slope	Poor: slope, large stones.

TABLE 8.—*Soil ratings for sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Sanitary landfill	Area sanitary landfill	Daily cover for sanitary landfills
Lordstown:					
LoB	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight	Fair: small stones, thin layer.
LoC	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: slope.
[1] LRE:					
Lordstown part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope.
Arnot part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, small stones, thin layer.
[1] LRF:					
Lordstown part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope.
Arnot part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, small stones, thin layer.
Madrid:					
MaB	Moderate: percs slowly.	Severe: slope	Slight	Slight	Fair: small stones.
MaC	Severe: slope	Severe: slope	Moderate: slope	Severe: slope	Poor: slope.
Mardin:					
MdB	Severe: percs slowly.	Moderate: small stones.	Moderate: wetness	Slight	Fair: small stones.
MdC	Severe: percs slowly.	Severe: slope	Moderate: wetness	Moderate: slope	Fair: small stones.
MdD, MdD3	Severe: slope, percs slowly.	Severe: slope	Moderate: wetness, slope.	Severe: slope	Poor: slope.
[1] MhC3:					
Mardin part	Severe: percs slowly.	Severe: slope	Moderate: wetness	Moderate: slope	Fair: small stones.
Ovid part	Severe: wetness, percs slowly.	Severe: slope	Severe: wetness	Moderate: wetness	Fair: thin layer.
[1] MnB:					
Mardin part	Severe: percs slowly, wetness.	Moderate: slope	Moderate: wetness	Slight	Fair: small stones.
Volusia part	Severe: wetness, percs slowly.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
[1] MnC:					
Mardin part	Severe: percs slowly, wetness.	Severe: slope	Moderate: wetness	Moderate: slope	Fair: small stones.
Volusia part	Severe: wetness, percs slowly.	Severe: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
Middlebury:					
Mp	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods	Good.
Morris:					
MrB	Severe: percs slowly.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
MrC	Severe: percs slowly.	Severe: slope	Severe: wetness	Moderate: wetness, slope.	Fair: small stones.
MSB	Severe: percs slowly.	Moderate: large stones.	Severe: wetness, large stones.	Moderate: wetness	Poor: large stones.
Niagara:					
NgB	Severe: percs slowly, wetness.	Moderate: slope	Severe: wetness	Moderate: wetness	Good.
Ochrepts and Orthents:					
OC	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.

TABLE 8.—*Soil ratings for sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Sanitary landfill	Area sanitary landfill	Daily cover for sanitary landfills
Oquaga:					
OgB	Severe: depth to rock.	Severe: slope	Severe: depth to rock.	Slight	Fair: thin layer.
OgC	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: slope.
OgD	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope.
Ovid:					
OvB	Severe: wetness, percs slowly.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: thin layer.
OvC	Severe: wetness, percs slowly.	Severe: slope	Severe: wetness	Moderate: wetness, slope.	Fair: thin layer.
Palms:					
Pa	Severe: wetness, floods.	Severe: wetness, excess humus, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Poor: excess humus, hard to pack.
Red Hook:					
Rh	Severe: wetness	Severe: wetness	Severe: wetness	Moderate: wetness	Fair: thin layer.
Scio:					
Sc	Severe: wetness	Moderate: seepage	Severe: seepage, wetness.	Severe: seepage	Good.
Tioga:					
Tg	Severe: floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Tuller:					
TuB, TuC	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: wetness	Poor: thin layer, small stones.
Unadilla:					
Un	Slight	Slight	Slight	Slight	Good.
Volusia:					
VoB	Severe: wetness, percs slowly.	Moderate: slope	Severe: wetness	Moderate: wetness	Fair: small stones.
VoC	Severe: wetness, percs slowly.	Severe: slope	Severe: wetness	Moderate: wetness, slope.	Fair: small stones.
VoD	Severe: slope	Severe: slope	Severe: wetness	Severe: slope	Poor: slope.
Wallington:					
Wa	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness	Moderate: wetness	Slight.
Warners:					
We	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, wetness.	Poor: wetness.
Wayland:					
Wn	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Wellsboro:					
WoB	Severe: percs slowly.	Moderate: slope, small stones.	Moderate: wetness	Slight	Fair: small stones.
WoC	Severe: percs slowly.	Severe: slope	Severe: wetness	Moderate: slope	Fair: small stones.
WoD	Severe: slope, percs slowly.	Severe: slope	Severe: wetness	Severe: slope	Poor: slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.—*Construction material*

[See text for definitions of "good," "fair," and "poor"]

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Alden:				
Aa	Poor: wetness, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Alton:				
AlA, AlB	Good	Fair: excess fines	Good	Poor: small stones.
Arnot:				
ARC	Poor: thin layer	Unsuited: excess fines	Unsuited: thin layer	Poor: small stones.
Atherton:				
At	Poor: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Bath:				
BaB	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
BaC	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
BaD, BBE	Poor: slope	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
Braceville:				
BrA, BrB	Fair: frost action	Poor: excess fines	Poor: excess fines	Fair: small stones, thin layer.
Canandaigua:				
Ca	Poor: wetness, low strength.	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Canaseraga:				
CbB	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
CbC	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: slope.
Carlisle:				
Cc	Poor: excess humus, low strength, frost action.	Unsuited: excess humus	Unsuited: excess humus	Poor: wetness.
Chenango:				
Ch	Good	Poor: excess fines	Poor: excess fines	Poor: small stones.
Chippewa:				
Ck	Poor: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Collamer:				
CoC	Fair: low strength	Poor: excess fines	Poor: excess fines	Fair: slope.
Dunkirk:				
DuC	Fair: low strength, frost action.	Unsuited: excess fines	Unsuited: excess fines	Fair: slope.
DuD	Fair: slope, low strength, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Edwards:				
Ed	Poor: excess humus, wetness, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Fluvaquents and Ochrepts:				
FL	Poor: wetness, area reclaim.	Poor: excess fines	Poor: excess fines	Poor: wetness, small stones.
Fremont:				
FrB	Fair: low strength, wetness.	Unsuited: excess fines	Poor: excess fines	Good.
Hornell:				
[1] HfB:				
Hornell part	Poor: low strength, wetness, thin layer.	Unsuited: excess fines	Unsuited: excess fines	Fair: small stones.
Fremont part	Fair: low strength, wetness.	Unsuited: excess fines	Poor: excess fines	Good.
[1] HfC:				
Hornell part	Poor: low strength, wetness, thin layer.	Unsuited: excess fines	Unsuited: excess fines	Fair: small stones.

TABLE 9.—*Construction material*—Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Hornell—Cont.:				
[1] HfC—Cont.:				
Fremont part	Fair: low strength, wetness.	Unsuited: excess fines	Poor: excess fines	Fair: slope.
[1] HgD:				
Hornell part	Poor: low strength, wetness, thin layer.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Fremont part	Fair: low strength, wetness.	Unsuited: excess fines	Poor: excess fines	Poor: slope.
[1] HHE:				
Hornell part	Poor: slope, low strength.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Fremont part	Poor: slope	Unsuited: excess fines	Poor: excess fines	Poor: slope.
[1] HkD3:				
Hornell part	Poor: low strength, wetness, thin layer.	Unsuited: excess fines	Unsuited: excess fines	Fair: small stones, too clayey.
Fremont part	Fair: low strength, wetness.	Unsuited: excess fines	Poor: excess fines	Poor: slope.
Howard:				
HoA, HoB	Good	Poor: excess fines	Good	Poor: small stones.
HoC	Good	Poor: excess fines	Good	Poor: slope, small stones.
[1] HpD:				
Howard part	Fair: slope	Poor: excess fines	Good	Poor: slope, small stones.
Dunkirk part	Fair: slope, low strength, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
[1] HrB:				
Howard part	Good	Poor: excess fines	Good	Poor: small stones.
Madrid part	Good	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
[1] HrC:				
Howard part	Good	Poor: excess fines	Good	Poor: slope, small stones.
Madrid part	Fair: slope	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
[1] HrD:				
Howard part	Fair: slope	Poor: excess fines	Good	Poor: slope, small stones.
Madrid part	Fair: slope	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
[1] HtD:				
Howard part	Fair: slope	Poor: excess fines	Good	Poor: slope, small stones.
Alton part	Fair: slope	Fair: excess fines	Good	Poor: slope, small stones.
[1] HtE:				
Howard part	Poor: slope	Poor: excess fines	Good	Poor: slope, small stones.
Alton part	Poor: slope	Fair: excess fines	Good	Poor: slope, small stones.
Kanona:				
KaA, KaB, KaD	Poor: low strength, frost action.	Unsuited: excess fines	Poor: excess fines	Poor: small stones, wetness.
Lackawanna:				
LaB	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
LaC	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.

TABLE 9.—*Construction material*—Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Lackawanna—Cont.:				
[1] LC:				
Lackawanna part	Fair: large stones, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, large stones.
Wellsboro part	Fair: large stones	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, large stones.
Lordstown:				
LoB	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: small stones.
LoC	Poor: thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: slope, small stones.
[1] LRE:				
Lordstown part	Poor: slope, thin layer	Unsuited: thin layer	Unsuited: thin layer	Poor: slope, small stones.
Arnot part	Poor: slope, thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
[1] LRF:				
Lordstown part	Poor: slope, thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
Arnot part	Poor: slope, thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
Madrid:				
MoB	Good	Unsuited: excess fines	Unsuited: excess fines	Good.
MoC	Fair: slope	Unsuited: excess fines	Unsuited: excess fines	Fair: slope.
Mardin:				
MdB, MdC	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
MdD, MdD3	Fair: slope, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.
[1] MhC3:				
Mardin part	Fair: slope, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
Ovid part	Poor: frost action	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
[1] MnB:				
Mardin part	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Volusia part	Fair: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
[1] MnC:				
Mardin part	Fair: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
Volusia part	Fair: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
Middlebury:				
Mp	Fair: wetness, frost action.	Unsuited: excess fines	Unsuited: excess fines	Good.
Morris:				
MrB, MrC	Poor: frost action	Unsuited: excess fines	Unsuited: excess fines	Fair: small stones.
MSB	Poor: frost action	Unsuited: excess fines	Unsuited: excess fines	Poor: large stones.
Niagara:				
NgB	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Ochrepts and Orthents:				
OC	Poor: slope	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Oquaga:				
OgB	Poor: thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
OgC	Poor: thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
OgD	Poor: slope	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Ovid:				
OvB, OvC	Poor: frost action	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.

TABLE 9.—*Construction material*—Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Palms:				
Pa	Poor: wetness, excess humus.	Unsuited: excess humus	Unsuited: excess humus	Poor: wetness.
Red Hook:				
Rh	Fair: wetness	Unsuited: excess fines	Poor: excess fines	Good.
Scio:				
Sc	Fair: low strength	Poor: excess fines	Unsuited: excess fines	Good.
Tioga:				
Tg	Fair: frost action	Unsuited: excess fines	Poor: excess fines	Good.
Tuller:				
TuB, TuC	Poor: thin layer	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
Unadilla:				
Un	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Volusia:				
VoB, VoC	Fair: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
VoD	Fair: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: slope.
Wallington:				
Wa	Poor: frost action	Unsuited: excess fines	Unsuited: excess fines	Good.
Warners:				
We	Poor: wetness, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Wayland:				
Wn	Poor: wetness, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Wellsboro:				
WoB, WoC	Fair: frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: small stones.
WoD	Fair: slope, frost action.	Unsuited: excess fines	Unsuited: excess fines	Poor: slope, small stones.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.—*Water management*

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Alden:						
Aa	Favorable	Favorable	Favorable	Wetness, percs slowly, poor outlets.	Not needed	Not needed.
Alton:						
AlA, AlB	Seepage	Seepage, piping.	No water	Not needed	Complex slope, piping.	Droughty, slope.
Arnot:						
ARC	Depth to rock, slope.	Thin layer, slope.	Depth to rock, slope.	Not needed	Depth to rock, slope.	Droughty, rooting depth, slope.
Atherton:						
At	Seepage	Piping, seepage.	Favorable	Wetness, poor outlets.	Wetness	Wetness.
Bath:						
BaB, BaC, BaD, BBE	Favorable, slope.	Favorable	No water	Not needed	Percs slowly, erodes easily.	Percs slowly, slope, erodes easily.
Braceville:						
BrA, BrB	Seepage	Low strength, piping.	Slow refill	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Canandaigua:						
Ca	Favorable	Low strength, unstable fill.	Slow refill	Poor outlets, cutbanks cave.	Not needed	Wetness.
Canaseraga:						
CbB, CbC	Slope	Low strength, compressible, piping.	No water	Not needed	Slope, rooting depth.	Slope, rooting depth.
Carlisle:						
Cc	Seepage	Excess humus	Favorable	Wetness, frost action, cutbanks cave.	Not needed	Not needed.
Chenango:						
Ch	Seepage	Seepage	Deep to water	Floods	Not needed	Not needed.
Chippewa:						
Ck	Favorable	Favorable	Slow refill	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Collamer:						
CoC	Slope	Low strength, seepage, piping.	Slow refill	Cutbanks cave	Erodes easily	Erodes easily.
Dunkirk:						
DuC, DuD	Seepage, slope	Low strength, piping.	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
Edwards:						
Ed	Seepage	Compressible, hard to pack, low strength.	Favorable	Wetness, cutbanks cave, poor outlets.	Not needed	Not needed.
Fluvaquents and Ochrepts:						
FL	Seepage	Piping, low strength.	Favorable	Floods, wetness, cutbanks cave.	Not needed	Not needed.
Fremont:						
FrB	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
Hornell:						
[1] HfB:						
Hornell part	Depth to rock, slope.	Compressible, low strength, piping.	Depth to rock	Percs slowly, slope, depth to rock.	Depth to rock, erodes easily, piping.	Erodes easily, rooting depth, slope.
Fremont part	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
[1] HfC:						
Hornell part	Depth to rock, slope.	Compressible, low strength, piping.	Depth to rock	Percs slowly, slope, depth to rock.	Depth to rock, erodes easily, piping.	Erodes easily, rooting depth, slope.
Fremont part	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
[1] HgD:						
Hornell part	Depth to rock, slope.	Compressible, low strength, piping.	Depth to rock	Percs slowly, slope, depth to rock.	Depth to rock, erodes easily, piping.	Erodes easily, rooting depth, slope.
Fremont part	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
[1] HHE:						
Hornell part	Depth to rock, slope.	Compressible, low strength, piping.	Depth to rock	Percs slowly, slope, depth to rock.	Depth to rock, erodes easily, piping.	Erodes easily, rooting depth, slope.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Hornell—Cont.:						
[1] HHE—Cont.:						
Fremont part	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
[1] HkD3:						
Hornell part	Depth to rock, slope.	Compressible, low strength, piping.	Depth to rock	Percs slowly, slope, depth to rock.	Depth to rock, erodes easily, piping.	Erodes easily, rooting depth, slope.
Fremont part	Slope	Low strength, compressible, piping.	Slow refill	Percs slowly, slope.	Slope, erodes easily.	Slope, erodes easily.
Howard:						
HoA, HoB, HoC	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
[1] HpD:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Dunkirk part	Seepage, slope	Low strength, piping.	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
[1] HrB:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Madrid part	Seepage, slope	Piping	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
[1] HrC:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Madrid part	Seepage, slope	Piping	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
[1] HrD:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Madrid part	Seepage, slope	Piping	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
[1] HtD:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Alton part	Seepage	Seepage, piping.	No water	Not needed	Complex slope, piping.	Droughty, slope.
[1] HtE:						
Howard part	Seepage, slope	Seepage	No water	Not needed	Slope	Droughty, slope.
Alton part	Seepage	Seepage, piping.	No water	Not needed	Complex slope, piping.	Droughty, slope.
Kanona:						
KaA, KaB, KaD	Seepage, slope	Low strength, seepage, piping.	Slow refill	Slope, favorable.	Wetness	Wetness, erodes easily.
Lackawanna:						
LaB, LaC	Favorable, slope.	Favorable	No water	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.
[1] LC:						
Lackawanna part	Favorable, slope.	Large stones	No water	Not needed	Large stones, percs slowly.	Large stones, percs slowly.
Wellsboro part	Slope, large stones.	Large stones	Deep to water, large stones.	Percs slowly, slope, large stones.	Percs slowly, slope, large stones.	Percs slowly, slope, large stones.
Lordstown:						
LoB, LoC	Depth to rock, slope, seepage.	Thin layer	Deep to water	Not needed	Depth to rock, rooting depth, slope.	Droughty, slope.
[1] LRE:						
Lordstown part	Depth to rock, slope, seepage.	Thin layer, slope.	Deep to water	Not needed	Depth to rock, rooting depth, slope.	Droughty, slope.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Lordstown—Cont.:						
[1] LRE—Cont.:						
Arnot part	Depth to rock, slope.	Thin layer, slope.	Depth to rock, slope.	Not needed	Depth to rock, slope.	Droughty, rooting depth, slope.
[1] LRF:						
Lordstown part	Depth to rock, slope, seepage.	Thin layer, slope.	Deep to water	Not needed	Depth to rock, rooting depth, slope.	Droughty, slope.
Arnot part	Depth to rock, slope.	Thin layer, slope.	Depth to rock, slope.	Not needed	Depth to rock, slope.	Droughty, rooting depth, slope.
Madrid:						
MaB, MaC	Seepage, slope	Piping	No water	Not needed	Slope, erodes easily.	Slope, erodes easily.
Mardin:						
MdB, MdC, MdD, MdD3	Slope	Favorable	Deep to water	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
[1] MhC3:						
Mardin part	Slope	Favorable	Deep to water	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Ovid part	Slope	Favorable	Slow refill	Wetness, percs slowly.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.
[1] MnB:						
Mardin part	Slope	Favorable	Deep to water	Percs slowly, slope.	Favorable	Percs slowly, slope.
Volusia part	Slope	Favorable	Slow refill	Slope, wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
[1] MnC:						
Mardin part	Slope	Favorable	Deep to water	Percs slowly, slope.	Favorable	Percs slowly, slope.
Volusia part	Slope	Favorable	Slow refill	Slope, wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Middlebury:						
Mp	Favorable	Piping, low strength.	Deep to water	Floods, wetness	Not needed	Not needed.
Morris:						
MrB, MrC	Slope	Favorable	Slow refill slope.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
MSB	Slope	Favorable, large stones.	Slow refill, large stones, slope.	Percs slowly, wetness.	Percs slowly, wetness, large stones.	Percs slowly, wetness, large stones.
Niagara:						
NgB	Slope	Low strength, piping, hard to pack.	Slow refill	Cutbanks cave, slope.	Erodes easily	Erodes easily.
Ochrepts and Orthents:						
OC	Slope		No water	Slope	Slope	Slope.
Oquaga:						
OgB, OgC, OgD	Depth to rock	Thin layer	No water	Not needed	Depth to rock	Droughty, rooting depth.
Ovid:						
OvB, OvC	Slope	Favorable	Slow refill	Wetness, percs slowly.	Wetness, percs slowly, slope.	Wetness, percs slowly, slope.
Palms:						
Pa	Seepage, excess humus.	Compressible, hard to pack, low strength.	Favorable	Wetness, floods, cutbanks cave.	Not needed	Not needed.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Red Hook: Rh	Seepage	Thin layer	Favorable	Wetness	Wetness	Wetness.
Scio: Sc	Seepage, slope	Low strength, piping.	Deep to water	Cutbanks cave	Slope, erodes easily.	Slope, erodes easily.
Tioga: Tg	Seepage	Piping, low strength, seepage.	Deep to water	Not needed	Not needed	Not needed.
Tuller: TuB, TuC	Depth to rock, seepage.	Thin layer	Slow refill, depth to rock.	Depth to rock, slope.	Depth to rock, slope.	Rooting depth, slope, droughty.
Unadilla: Un	Seepage	Low strength, piping, seepage.	Deep to water	Not needed	Not needed	Erodes easily.
Volusia: VoB, VoC, VoD	Slope	Favorable	Slow refill	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Wallington: Wa	Favorable	Piping, low strength.	Deep to water	Percs slowly	Percs slowly, erodes easily, wetness.	Percs slowly, erodes easily, wetness.
Warners: We	Favorable	Piping	Favorable	Wetness, floods, poor outlets.	Not needed	Wetness.
Wayland: Wn	Favorable	Piping	Favorable	Wetness, floods, poor outlets.	Not needed	Wetness.
Wellsboro: WoB, WoC, WoD	Slope	Favorable	Deep to water	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 7 have an all-weather surface that carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight,* soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and as a result ground water supplies in the area may be contaminated. Soils having a hazard of inadequate filtration is indicated by footnotes in table 8.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread compacted in layers and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 8 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction materials

The suitability for each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed and described as the survey is made, generally about 6 feet.

Road fill is soil material used in embankments for

roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 11 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified soil classification systems, soils rated *good* have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*, regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in tables 11 and 12.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable materials is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils, very firm clayey soils, soils with suitable layers less than 8 inches thick, soils having large amounts of gravel, stones or soluble salt, steep soils, and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as Al or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plants growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

An *aquifer-fed excavated pond* is a body of water created by excavating a pit or dugout into a groundwater aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth of claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage (fig. 9).

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

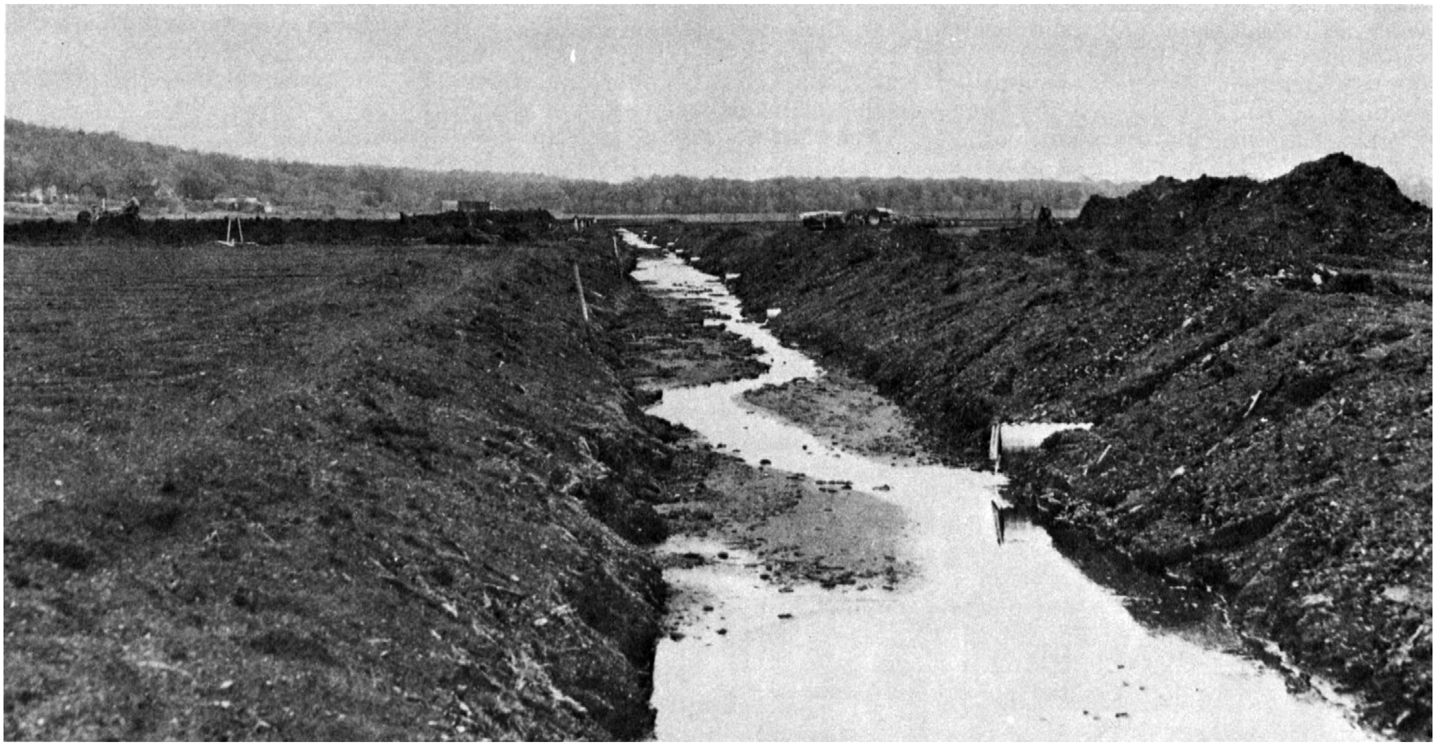

Figure 9.—**A drainage ditch in Carlisle muck; this organic soil is used to grow vegetables.**

Soil Properties [6]

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important soil properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness and the color of the soil; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

[6] EDWARD A. FERNAU, senior soil engineer, New York State Department of Transportation, Soil Mechanics Bureau; and DONALD W. SHANKLIN, state conservation engineer, Soil Conservation Service, helped prepare this section.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 to 6 feet, horizons of contrasting properties. Information is presented in the table for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in "Descriptions of the Soils."

Texture is described in table 11 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains

TABLE 11.—*Estimated engineering properties and classifications*

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Alden: Aa	0–8	Silt loam	ML, OL	A–4, A–6, A–7	0	95–100	85–100	70–95	55–85	40–50	5–15
	8–25	Silt loam, silty clay loam.	ML, CL	A–4, A–6	0	95–100	85–100	75–95	60–85	20–35	5–15
	25–60	Channery loam, shaly silty clay loam.	SM, CL, GM, GC	A–2, A–4, A–6	5	60–95	50–80	45–80	30–75	20–35	5–15
Alton: AlA, AlB	0–6	Gravelly fine sandy loam.	SM, ML, GM	A–2, A–4	0–5	65–75	60–70	30–65	10–60	<10	NP–3
	6–36	Very gravelly loam, very gravelly sandy loam.	GM, SM	A–2, A–4	5–25	45–70	35–55	20–50	20–40	<10	NP–3
	36–60	Very gravelly sandy loam, very gravelly sand.	SM, GP	A–1	10–25	45–60	40–50	20–35	2–15	—	NP
Arnot: ARC	0–7	Channery silt loam.	ML, GM	A–2, A–4	5–10	55–75	45–70	40–65	30–60	10–30	2–4
	7–17	Very channery silt loam, very channery loam.	ML, GM	A–2, A–4	10–25	50–65	40–60	35–55	30–55	10–30	2–4
	17	Unweathered bedrock.									
Atherton: At	0–22	Silt loam	ML, OL, CL–ML	A–4, A–5, A–7, A–6	0–5	85–100	70–100	65–100	55–90	30–50	10–30
	22–60	Silt loam, silty clay loam, gravelly loam.	ML, GM, GC, CL GH–GC	A–4, A–6, A–1	0–5	45–95	40–95	35–90	20–80	30–40	10–30
Bath: BaB, BaC, BaD, BBE:	0–23	Channery silt loam.	ML, GM, GC, OL	A–1, A–2, A–4, A–5	5–10	45–95	40–75	35–75	25–65	30–35	6–10
	23–31	Channery loam, channery silt loam.	ML, SM	A–1, A–2, A–4	5–10	65–95	50–80	40–75	25–55	20–24	2–4
	31–41	Channery loam, channery silt, loam, channery sandy loam.	SM, GM, GC, SC	A–1, A–2, A–4	10–15	40–75	30–70	20–65	10–45	20–24	4–6
	41–60	Channery loam, channery silt loam, channery sandy loam.	GM, GC	A–1, A–2, A–4	10–15	40–70	30–70	20–65	10–45	19–24	4–6
Braceville: BrA, BrB	0–8	Gravelly silt loam.	SM, ML, CL	A–4, A–6	0–10	65–90	55–75	50–70	40–55	—	—
	8–24	Gravelly loam, silt loam, gravelly sandy loam.	ML, CL, SM	A–4, A–2	0–10	65–90	50–80	35–70	20–55	—	—
	24–36	Gravelly loam, gravelly silt loam.	ML, CL, SM, SC	A–2, A–4	0–10	65–100	50–75	40–75	30–65	15–40	NP–10
	36–60	Stratified sand and gravel.	GM, GC SM	A–1, A–2, A–4	0–15	40–100	35–100	25–90	10–50	<30	NP–5

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Canandaigua:											
Co	0–9	Silt loam	ML, OL, CL	A–4, A–6, A–7	0	95–100	95–100	90–100	85–100	38–80	8–15
	9–26	Silt loam, silty clay loam.	CL, ML	A–4, A–6	0	95–100	95–100	90–100	70–95	20–40	7–12
	26–60	Silt loam	CL, ML	A–4	0	95–100	95–100	90–100	70–90	20–30	6–10
Canaseraga:											
CbB, CbC	0–28	Silt loam, very fine sandy loam.	ML	A–4	0–2	95–100	95–100	85–95	50–90	<20	NP–4
	28–62	Channery silt loam, channery loam.	ML, CL, GC, GM	4–4, A–2	5–10	65–85	60–80	50–75	30–75	15–25	2–6
Carlisle:											
Cc	0–70	Muck	Pt								
	70–99	Marl			0	100	95–100	95–100	70–85		
Chenango:											
Ch	0–8	Channery silt loam.	ML, GM, SM	A–2, A–4	5–15	55–85	50–80	25–75	15–65	<35	NP–10
	8–34	Channery silt loam, channery loam, very channery fine sandy loam.	ML, GM, SM	A–2, A–4	5–20	45–85	40–80	30–75	15–65	<35	NP–10
	34–60	Very channery sandy loam, very gravelly loamy sand.	GM, GW–GM	A–1, A–2, A–4	10–20	35–60	30–55	20–55	10–45	<35	NP–10
Chippewa:											
Ck	0–13	Channery silt loam.	GM, ML, CL, GC	A–2, A–4, A–7, A–6	0–10	65–100	60–100	50–100	35–100	35–50	5–15
	13–40	Channery silt loam.	GM, ML, CL, GC	A–4	10–25	60–85	55–75	50–70	40–65	15–25	4–10
	40–64	Channery silt loam.	GM, ML, CL, GC	A–4	10–25	60–80	55–70	50–70	40–65	25–35	5–10
Collamer:											
CoC	0–11	Silt loam	ML, SM	A–4	0	95–100	90–100	65–95	40–85	20–30	5–10
	11–39	Silt loam, silty clay loam.	ML, CL	A–4, A–6	0	95–100	95–100	90–100	75–95	20–30	5–15
	39–60	Silt loam, silty clay loam.	ML	A–4	0	95–100	95–100	90–100	70–90	<15	NP–4
Dunkirk:											
DuC, DuD	0–8	Silt loam	ML, CL	A–4	0	95–100	90–100	80–100	65–90	20–30	5–10
	8–14	Silt loam	ML, CL	A–4	0	95–100	90–100	80–100	65–90	20–30	5–10
	14–39	Silt loam, silty clay loam.	ML, CL	A–4, A–6	0	95–100	90–100	80–100	65–95	20–30	5–15
	39–60	Stratified silt to very fine sand.	ML, SM	A–4	0	95–100	90–100	70–100	40–95	<15	NP–4
Edwards:											
Ed	0–30	Muck	Pt	A–8	0						
	30–60	Marl	ML, CL	A–4, A–6	0	100	95–100	80–90	60–80		
Fluvaquents and Ochrepts:											
Fl	0–60	Variable									
Fremont:											
FrB	0–10	Silt loam	ML, CL	A,6, A–7, A–4	0–10	95–100	90–100	80–100	70–95	35–45	10–20
	10–32	Silt loam, silty clay loam, shaly silty clay loam.	ML, CL	A–6, A–4	0–10	75–100	70–95	65–95	50–85	25–40	10–20
	32–60	Channery silt loam, shaly silty clay loam.	ML, CL, GC, GM	A–6, A–4	0–10	70–85	65–75	55–75	45–65	25–40	5–15

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Hornell: [1] HfB, HfC, HgD, HHE: Hornell part	0–7	Silt loam	ML, CL	A-4, A-6, A-7	0	95–100	90–100	80–100	65–90	35–45	10–20
	7–33	Silty clay, silty clay loam, shaly silty clay loam.	ML, CL	A-6, A-7	0–5	80–95	75–90	65–90	60–85	35–45	10–20
	33–38	Shaly silty clay, shaly silty clay loam, shaly clay.	ML, CL, GC	A-6, A-7	0–5	60–80	55–75	50–75	45–70	35–45	10–20
	38	Weathered bedrock.									
Fremont part	0–10	Silt loam	ML, CL	A-6, A-7, A-4	0–10	95–100	90–100	80–100	70–95	35–45	10–20
	10–32	Silt loam, silty clay loam, shaly silty clay loam.	ML, CL	A-6, A-4	0–10	75–100	70–90	65–95	50–85	25–40	10–20
	32–60	Channery silt loam, shaly silty clay loam.	ML, CL, GC, GM	A-6, A-4	0–10	70–85	65–80	55–75	45–70	25–40	5–15
[1] HkD3: Hornell part	0–7	Silty clay loam	ML, CL	A-4, A-6, A-7	0	95–100	90–100	80–100	65–90	35–45	10–20
	7–33	Silty clay, silty clay loam, shaly silty clay loam.	ML, CL	A-6, A-7	0–5	80–95	75–90	65–90	60–85	35–45	10–20
	33–38	Shaly silty clay, shaly silty clay loam, shaly clay.	ML, CL, GC	A-6, A-7	0–5	60–80	55–75	50–75	45–70	35–45	10–20
	38	Weathered bedrock.									
Fremont part	0–10	Silty clay loam	ML, CL	A-6, A-7, A-4	0–10	95–100	90–100	80–100	70–95	35–45	10–20
	10–32	Silt loam, silty clay loam, shaly silty clay loam.	ML, CL	A-6, A-4	0–10	75–100	70–95	65–95	50–85	25–40	10–20
	32–60	Channery silt loam, shaly silty clay loam.	ML, CL, GC, GM	A-6, A-4	0–10	70–85	65–80	55–75	45–70	25–40	5–15
Howard: HoA, HoB, HoC	0–9	Gravelly loam	SM, GM, ML, OL	A-4, A-2, A-1	0–5	55–80	50–75	30–70	15–65	25–35	5–10
	9–24	Gravelly loam, very gravelly loam.	GC, GM-GC	A-4, A-2, A-1	0–5	25–65	25–60	20–55	15–45	15–25	5–10
	24–45	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam.	GM, GC	A-4, A-2, A-1	5–10	25–55	20–50	15–45	10–40	25–40	5–20
	45–72	Stratified sand and gravel.	GW, GP	A-1	5–15	25–45	25–40	10–30	0–5	-------	NP

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Howard—Cont.:											
[1] HpD:											
Howard part	0–9	Gravelly loam	SM, GM, ML, OL	A-4, A-2, A-1	0–5	55–80	50–75	30–70	15–65	25–35	5–10
	9–24	Gravelly loam, very gravelly loam.	GC, GM-GC	A-4, A-2, A-1	0–5	25–65	25–60	20–55	15–45	15–25	5–10
	24–45	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam.	GM, GC	A-4, A-2, A-1	5–10	25–55	20–50	15–45	10–40	25–40	5–20
	45–72	Stratified sand and gravel.	GW, GP	A-1	5–15	25–45	25–40	10–30	0–5	-------	NP
Dunkirk part	0–8	Silt loam	ML	A-4	0	95–100	90–100	75–100	65–90	20–30	5–10
	8–14	Silt loam	ML, CL	A-4	0	95–100	90–100	80–100	65–90	20–30	5–10
	14–39	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	95–100	90–100	80–100	65–95	20–30	5–15
	39–60	Stratified silt to very fine sand.	ML, SM	A-4	0	95–100	90–100	70–100	40–95	<15	NP-4
[1] HrB, HrC, HrD:											
Howard part	0–9	Gravelly loam	SM, GM, ML, OL	A-4, A-2, A-1	0–5	55–80	50–75	30–70	15–65	25–35	5–10
	9–24	Gravelly loam, very gravelly loam.	GC, GM-GC	A-4, A-2, A-1	0–5	25–65	25–60	20–55	15–45	15–25	5–10
	24–45	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam.	GM, GC	A-4, A-2, A-1	5–10	25–55	20–50	15–45	10–40	25–40	5–20
	45–72	Stratified sand and gravel.	GW, GP	A-1	5–15	25–45	25–40	10–30	0–5	-------	NP
Madrid part	0–22	Fine sandy loam	ML, SM	A-2, A-4	0	80–100	75–100	50–90	30–90	30–40	5–10
	22–64	Gravelly fine sandy loam, silt loam.	SM, ML, GM	A-2, A-4, A-1	0–5	60–85	45–95	35–95	20–85	20–30	5–10
[1] HtD, HtE:											
Howard part	0–9	Gravelly loam	SM, GM, ML, OL	A-4, A-2, A-1	0–5	55–80	50–75	30–70	15–65	25–35	5–10
	9–24	Gravelly loam, very gravelly loam.	GC, GM-GC	A-4, A-2, A-1	0–5	25–65	25–60	20–55	15–45	15–25	5–10
	24–45	Very gravelly loam, very gravelly sandy clay loam, very gravelly sandy loam.	GM, GC	A-4, A-2, A-1	5–10	25–55	20–50	15–45	10–40	25–40	5–20
	45–72	Stratified sand and gravel.	GW, GP	A-1	5–15	25–45	25–40	10–30	0–5	-------	NP
Alton part	0–6	Gravelly fine sandy loam.	SM, ML, GM	A-2, A-4	0–5	65–75	60–70	30–65	10–60	<10	NP-3
	6–36	Very gravelly loam, very gravelly sandy loam.	GM, SM	A-2, A-4	5–25	45–70	35–55	20–50	20–40	<10	NP-3
	36–60	Very gravelly sandy loam, very gravelly sand.	SM, GP	A-1	10–25	45–60	40–50	20–35	2–15	-------	NP

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number— 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
Kanona: KaA, KaB, KaD	0–8	Silty clay loam	ML, CL	A-6, A-7	5–10	80–95	75–90	70–90	55–80	30–50	15–20
	8–30	Shaly silty clay, silty clay loam, silty clay.	ML, CL, GM, GC	A-6, A-7	5–10	55–90	50–90	45–90	40–85	30–50	15–20
	30–72	Shaly silty clay, silty clay, silty clay loam.	ML, CL, GM, GC	A-6, A-7, A-2	5–10	55–85	35–80	35–80	30–80	30–50	15–20
Lackawanna: LaB, LaC	0–7	Channery silt loam.	GM, ML, CL, SM, SM-SC	A-2, A-4	0–15	40–90	40–75	35–75	20–60	------	------
	7–27	Channery silt loam, channery sandy loam.	GM, ML, CL, SM	A-2, A-4, A-6	0–20	40–90	40–75	25–70	15–60	20–35	1–14
	27–60	Flaggy silt loam, channery silt loam, channery sandy loam.	GM, SM, ML, CL	A-2, A-4, A-6	0–20	50–95	40–75	25–75	15–70	15–35	<12
[1] LC: Lackawanna part.	0–7	Extremely stony silt loam.	ML, CL, GM, SM	A-4, A-2	5–20	40–100	40–95	35–90	20–85	------	------
	7–27	Channery silt loam, channery sandy loam.	GM, ML, CL, SM	A-2, A-4, A-6	0–20	40–80	40–75	25–70	15–60	20–35	1–14
	27–60	Flaggy silt loam, channery silt loam, channery sandy loam.	GM, SM, ML, CL	A-2, A-4, A-6	0–20	50–85	40–75	25–75	15–55	15–35	<12
Wellsboro part.	0–7	Extremely stony silt loam.	ML, CL, SM	A-4, A-2	3–20	70–100	65–75	60–75	30–70	------	------
	7–18	Channery silt loam, channery loam.	SC, ML, CL, SM	A-2, A-4	0–15	70–100	60–75	55–75	30–70	15–40	NP–10
	18–60	Channery silt loam, channery loam.	GM, ML, CL, SM	A-2, A-4	0–20	55–90	45–70	35–65	25–65	15–30	NP–10
Lordstown: LoB, LoC	0–9	Channery silt loam.	ML, GM	A-4	5–10	65–85	50–75	50–75	40–65	<30	NP–4
	9–27	Very channery silt loam, channery very fine sandy loam.	ML, GM	A-4, A-2	5–10	65–85	40–75	35–75	25–65	<30	NP–4
	27–36	Very flaggy silt loam, channery fine sandy loam.	ML, GM	A-2, A-4	5–25	40–75	30–70	25–70	15–60	<30	NP–4
	36	Unweathered bedrock.									

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
Lordstown—Cont.:											
[1] LRE, LRF: Lordstown part.	0–9	Channery silt loam.	ML, GM	A–4	5–10	65–85	50–75	50–75	40–65	<30	NP–4
	9–27	Very channery silt loam, channery very fine sandy loam.	ML, GM	A–4, A–2	5–10	65–85	40–75	35–75	25–65	<30	NP–4
	27–36	Very flaggy silt loam, channery fine sandy loam.	ML, GM	A–2, A–4	5–25	40–75	30–70	25–70	15–60	<30	NP–4
	36	Unweathered bedrock.									
Arnot part	0–7	Channery silt loam.	ML, GM	A–2, A–4	5–10	55–75	45–70	40–65	30–60	10–30	2–4
	7–17	Very channery silt loam, very channery loam.	ML, GM	A–2, A–4	10–25	50–65	40–60	35–55	30–55	10–30	2–4
	17	Unweathered bedrock.									
Madrid: MaB, MaC	0–22	Fine sandy loam	ML, SM	A–2, A–4	0	80–100	75–100	50–90	30–90	30–40	5–10
	22–64	Gravelly fine sandy loam, silt loam.	SM, ML, GM	A–2, A–4, A–1	0–5	60–85	45–95	35–95	20–85	20–30	5–10
Mardin: MdB, MdC, MdD, MdD3.	0–19	Channery silt loam.	GM, ML, CL, GC	A–4	5–10	65–75	65–80	60–80	50–60	25–35	5–10
	19–60	Channery loam, channery silt loam, very channery loam.	GM, ML, CL, GC	A–2, A–4	10–25	55–75	50–70	40–70	30–65	20–30	5–10
[1] MhC3: Mardin part	0–19	Channery silt loam.	GM, ML, CL, GC	A–4	5–10	65–75	65–80	60–80	50–60	25–35	5–10
	19–60	Channery loam, channery silt loam, very channery loam.	GM, ML, CL, GC	A–2, A–4	10–25	55–75	50–70	40–70	30–65	20–30	5–10
Ovid part	0–15	Silt loam	ML, CL	A–4, A–6, A–7	0	90–100	85–100	75–95	60–90	35–45	5–15
	15–34	Silty clay loam, gravelly silt loam.	CL, ML	A–4, A–6	0–5	65–100	65–95	60–95	55–90	25–35	5–15
	34–60	Silty clay loam, gravelly silt loam.	CL, ML	A–4, A–6	0–5	65–90	65–90	60–85	50–80	20–35	5–15
[1] MnB, MnC: Mardin part	0–9	Channery silt loam.	ML, CL	A–4	0–5	80–90	75–90	65–90	55–80	25–35	5–10
	9–19	Channery silt loam.	GM, ML, CL, GC	A–4	5–10	55–75	65–80	60–80	50–65	20–30	5–10
	19–60	Channery loam, channery silt loam, very channery loam.	GM, ML, CL, GC	A–4, A–2	10–25	55–75	50–70	40–70	30–65	20–30	5–10
	60–70	Silt loam, silty clay loam, very fine sandy loam.	ML, CL, SM	A–4, A–5, A–6, A–7	0	95–100	95–100	80–100	45–90	15–45	5–25

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number—: 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
Mardin—Cont.: [1] MnB, MnC—Cont.: Volusia part	0–7	Channery silt loam.	ML, CL, OL	A–4, A–7	0–5	80–90	75–90	65–90	55–80	30–45	5–15
	7–15	Channery silt loam, channery loam, gravelly loam.	GM, ML, CL, GC	A–2, A–4	5–10	60–90	55–85	45–85	35–75	15–30	5–10
	15–46	Channery silt loam, channery loam, very channery loam.	GM, ML, CL, GC	A–2, A–4	10–25	55–80	50–70	40–65	30–60	20–30	5–10
	46–60	Channery loam, very channery loam, channery silt loam.	CL, CL–ML, GM–GC, GC	A–2, A–4	10–25	55–80	50–70	40–65	30–60	20–30	5–10
	60–70	Silt loam, silty clay loam, very fine sandy loam.	ML, CL, SM	A–4, A–5, A–6, A–7	0	95–100	95–100	80–100	45–90	15–45	5–25
Middlebury: Mp	0–12	Silt loam	ML, SM	A–4	0	85–100	75–100	65–100	45–85	<20	NP–4
	12–41	Silt loam, loam, gravelly fine sandy loam.	ML, SM	A–4, A–2	0	80–100	70–100	50–100	30–85	<20	NP–4
	41–61	Very gravelly loamy sand.	GP–GM, GM, SM	A–1	10–25	45–60	40–50	20–40	2–15	----	NP
Morris: MrB, MrC	0–15	Channery silt loam.	ML, CL, SM	A–4	0–10	80–100	60–75	55–75	45–70	20–30	1–3
	15–60	Channery silt loam, channery loam.	GM, GM, CL, SM	A–2, A–4	0–20	60–95	50–75	40–75	30–70	15–25	1–5
MSB	0–15	Extremely stony loam.	GM, ML, CL, SM	A–4, A–2	5–20	60–95	55–75	40–70	35–55	20–30	1–3
	15–60	Channery loam, channery silt loam.	GM, ML, CL, SM	A–2, A–4	0–20	60–95	50–75	40–75	30–70	15–25	1–3
Niagara: NgB	0–16	Silt loam	ML, CL	A–4	0	95–100	90–100	70–95	50–90	35–45	5–15
	16–42	Silt loam, silty clay loam.	ML, CL	A–4	0	95–100	95–100	90–100	65–95	15–25	2–10
	42–60	Stratified silt and very fine sand.	ML, SM	A–4, A–2	0	95–100	95–100	70–100	30–95	<15	NP–4
Ochrepts and Orthents: OC	0–60	Variable									
Oquaga: OgB, OgC, OgD	0–17	Channery silt loam.	ML, GM	A–4, A–2	5–10	50–85	40–70	35–70	25–65	<25	NP–5
	17–32	Very channery loam, very channery silt loam, channery silt loam.	GM, ML	A–1, A–2, A–4	10–25	35–70	25–60	20–60	15–55	<25	NP–5
	32	Unweathered bedrock.									

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Ovid:											
OvB, OvC	0–15	Silt loam	ML, SM, CL	A-4, A-6, A-7	0	90–100	85–100	60–95	40–90	35–45	5–15
	15–34	Silty clay loam, gravelly silt loam.	CL, ML	A-4, A-6	0–5	65–100	65–95	60–95	55–90	25–35	5–15
	34–60	Silty clay loam, gravelly silt loam.	CL, ML, GC	A-4, A-6, A-2	0–5	55–90	50–90	40–85	30–80	20–35	5–15
Palms:											
Pa	0–21	Muck	Pt	A-8	---	---	---	---	---	---	---
	21–60	Clay loam, silt loam, fine sandy loam.	CL-ML, CL, SM	A-4, A-6	0	95–100	95–100	70–95	40–80	12–30	6–12
Red Hook:											
Rh	0–6	Silt loam	ML, SM, OL	A-4	0–5	80–95	75–90	65–90	45–80	20–40	2–4
	6–22	Silt loam, loam, gravelly sandy loam.	ML, SM, GM	A-1, A-2, A-4	0–5	60–90	55–90	35–90	20–80	20–30	2–4
	22–60	Gravelly loam, gravelly silt loam, gravelly sandy loam.	GM, ML, SM	A-1, A-2, A-4	5–10	60–90	55–80	35–80	20–70	20–30	2–4
Scio:											
Sc	0–9	Silt loam	ML	A-4	0	100	95–100	90–100	60–90	10–40	2–6
	9–42	Silt loam, very fine sandy loam.	ML	A-4	0	100	95–100	90–100	60–90	10–30	NP–6
	42–60	Stratified very gravelly sand to silt loam.	ML, SM, SP	A-4, A-2, A-1	0	35–100	30–50	15–85	2–80	<25	NP–4
Tioga:											
Tg	0–10	Silt loam	ML, SM	A-4	0	100	95–100	65–95	40–85	<15	NP–4
	10–60	Silt loam, fine sandy loam, loam.	ML, SM	A-4	0	100	95–100	65–95	40–85	<15	NP–2
Tuller:											
TuB, TuC	0–6	Channery silt loam.	GM, SM	A-2, A-4	5–10	55–75	45–55	40–55	35–50	10–30	2–4
	6–13	Very channery silt loam.	GM, SM	A-2, A-4	10–20	50–70	45–55	40–55	35–50	10–30	2–4
	13	Unweathered bedrock.									
Unadilla:											
Un	0–8	Silt loam	ML	A-4	0	100	95–100	90–100	60–90	10–20	2–4
	8–41	Silt loam, very fine sandy loam.	ML	A-4	0	100	95–100	90–100	60–90	10–20	2–4
	41–60	Very gravelly sandy loam, very gravelly sand, silt loam.	GP, GM, ML	A-1, A-2, A-4	0–5	45–100	40–95	20–90	0–70	---	NP

TABLE 11.—*Estimated engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Volusia: VoB, VoC, VoD	0–7	Channery silt loam.	GM, ML, CL, GC	A-4	5–10	65–80	60–80	50–80	40–70	30–40	5–10
	7–15	Channery silt loam, channery loam, silty clay loam.	GM, ML, CL, GC	A-4	5–10	60–85	55–85	45–85	35–80	15–25	5–10
	15–46	Channery silt loam, channery loam, silty clay loam.	GM, ML, CL, GC	A-4	5–10	65–90	60–85	50–85	40–80	20–30	5–10
	46–62	Channery loam, very channery loam, channery silt loam.	GM-GC, GC, CL-ML, CL	A-2, A-4	5–25	45–90	35–80	30–80	25–70	20–30	5–10
Wallington: Wa	0–3	Silt loam	ML	A-4	0	95–100	90–100	85–100	55–90	20–30	1–4
	3–12	Very fine sandy loam, silt loam.	ML	A-4	0	100	95–100	90–100	65–90	10–20	1–4
	12–38	Very fine sandy loam, silt loam.	ML	A-4	0	100	95–100	90–100	65–90	10–20	1–4
	38–62	Stratified silt to very fine sand, very fine sandy loam.	ML, SM	A-4	0	95–100	90–100	65–95	40–90	<10	NP–4
Warners: We	0–13	Silt loam	ML, CL, OL	A-7, A-5	0	95–100	95–100	90–100	70–95	42–50	5–15
	13–60	Marl			0						
Wayland: Wn	0–8	Silt loam	ML, CL, OL	A-7, A-5	0	100	95–100	90–100	70–95	40–50	5–15
	8–47	Silt loam, silty clay loam.	ML, CL	A-6, A-4	0	100	95–100	90–100	70–95	20–40	5–15
	47–60	Stratified silt and very fine sand.	ML, CL, SM	A-4	0	100	95–100	70–95	40–90	15–40	NP–10
Wellsboro: WoB, WoC, WoD	0–7	Channery silt loam.	ML, CL, SM	A-2, A-4	0–15	70–90	65–75	60–75	30–70		
	7–18	Channery silt loam, channery loam.	ML, CL, SM, SC	A-2, A-4	0–15	70–100	60–75	55–75	30–70	15–25	5–10
	18–60	Channery silt loam, channery loam.	SM, GM, ML, CL	A-2, A-4	0–20	55–90	45–70	35–65	25–60	15–30	NP–10

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and that of the American Association of State Highway and Transportation Officials (AASHTO) (*1*). In table 11 soils in the survey area are classified according to both systems (*6*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the Unified and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavoir.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and observations of the many soil borings made during the survey.

Physical and chemical properties

Table 12 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 12, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Instal-

TABLE 12.—*Estimated physical and chemical properties*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	*In/hr*	*In/in*	*pH*					
Alden:									
Aa	0–8	0.6–2.0	0.16–0.22	6.1–7.3	Low	High	Low		
	8–25	0.2–0.6	0.14–0.20	6.1–7.3	Low	High	Low		
	25–60	0.2–0.6	0.08–0.15	6.6–8.4	Low	High	Low		
Alton:									
AlA, AlB	0–6	2.0–6.0	0.04–0.14	4.5–5.5	Low	Low	High	0.17	3
	6–36	2.0–6.0	0.04–0.09	5.6–7.8	Low	Low	Moderate	0.17	
	36–60	<6.0	0.02–0.04	6.6–7.8	Low	Low	Low	0.17	
Arnot:									
ARC	0–7	0.6–2.0	0.10–0.15	4.5–6.0	Low	Low	High	0.20	2
	7–17	0.6–2.0	0.08–0.12	4.5–6.0	Low	Low	High	0.17	
	17								
Atherton:									
At	0–22	0.6–2.0	0.16–0.21	5.1–7.3	Low	High	Low		
	22–60	0.6–2.0	0.10–0.19	5.6–7.8	Low	High	Low		
Bath:									
BaB, BaC, BaD, BBE	0–23	0.6–2.0	0.10–0.20	4.5–6.0	Low	Moderate	Moderate	0.17	3
	23–31	0.6–2.0	0.08–0.18	4.5–6.0	Low	Moderate	Moderate	0.28	
	31–41	0.06–0.2	0.00–0.06	4.5–6.5	Low	Moderate	Moderate	0.28	
	41–60	0.06–0.2	—	5.1–7.8	Low	Moderate	Moderate	0.28	
Braceville:									
BrA, BrB	0–8	0.2–2.0	0.08–0.12	4.5–6.0	Low	Moderate	Moderate	0.20	3–2
	8–24	0.2–2.0	0.08–0.12	4.5–6.0	Low	Moderate	Moderate	0.20	
	24–36	0.06–0.6	0.06–0.10	4.5–6.0	Low	Moderate	Moderate	0.28	
	36–60	2.0–20	0.03–0.06	5.1–6.5	Low	Moderate	Moderate	0.17	
Canandaigua:									
Ca	0–9	0.6–2.0	0.20–0.35	5.6–7.8	Low	High	Low	0.49	3
	9–26	0.2–0.6	0.19–0.20	6.1–7.8	Low	High	Low	0.49	
	26–60	0.2–0.6	0.19–0.20	6.6–8.4	Low	High	Low	0.49	
Canaseraga:									
CbB, CbC	0–28	0.6–2.0	0.17–0.21	4.5–6.0	Low	Moderate	Moderate	0.49	3
	28–62	0.06–0.2	0.02–0.04	5.1–7.8	Low	Moderate	Low	0.28	
Carlisle:									
Cc	0–70	6.0–20	0.35–0.45	5.6–7.3		High	Low		
	70–99			7.9–8.4					
Chenango:									
Ch	0–8	2.0–6.0	0.08–0.15	4.5–5.5	Low	Low	Moderate	0.17	3
	8–34	2.0–6.0	0.05–0.14	4.5–6.0	Low	Low	Moderate	0.17	
	34–60	6.0–20	0.04–0.11	5.1–6.5	Low	Low	Moderate	0.17	
Chippewa:									
Ck	0–13	0.6–2.0	0.11–0.18	4.5–5.5	Low	High	Moderate	0.24	3
	13–40	<0.06	0.01–0.02	5.1–6.5	Low	High	Moderate	0.28	
	40–64	<0.06	0.01–0.02	5.6–7.3	Low	High	Low	0.28	
Collamer:									
CoC	0–11	0.6–2.0	0.14–0.21	5.1–7.3	Low	Moderate	Low	0.45	3
	11–39	0.2–0.6	0.16–0.20	5.6–7.3	Low	Moderate	Low	0.43	
	39–60	0.2–0.6	0.12–0.20	6.1–7.4	Low	Moderate	Low	0.64	
Dunkirk:									
DuC, DuD	0–8	0.0–2.0	0.16–0.21	5.1–7.3	Low	Low	Low	0.49	3
	8–14	0.6–2.0	0.16–0.20	5.1–7.3	Low	Low	Low	0.43	
	14–39	0.2–0.6	0.16–0.20	5.6–7.8	Low	Low	Low	0.43	
	39–60	0.2–0.6	0.12–0.20	6.1–7.8	Low	Low	Low	0.64	
Edwards:									
Ed	0–30	6.0–20	0.35–0.45	5.6–7.8		High	Low		
	30–60			7.4–8.4		High	Low		
Fluvaquents and Ochrepts:									
FL	0–60								

TABLE 12.—*Estimated physical and chemical properties*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	*In/hr*	*In/in*	*pH*					
Fremont:									
FrB	0–10	0.6–2.0	0.17–0.21	4.5–6.0	Low	High	High	0.32	3
	10–32	0.2–2.0	0.12–0.19	4.5–6.0	Low	High	High	0.28	
	32–60	<0.2	0.11–0.16	5.6–7.3	Low	High	High	0.43	
Hornell:									
[1] HfB, HfC, HgD, HHE:									
Hornell part	0–7	0.6–2.0	0.16–0.21	3.6–5.5	Low	High	High	0.43	3
	7–33	0.2–0.6	0.11–0.13	4.5–5.5	Moderate	High	High	0.28	
	33–38	<0.06	0.07–0.13	4.5–5.5	Moderate	High	High	0.17	
	38								
Fremont part	0–10	0.6–2.0	0.17–0.21	4.5–6.0	Low	High	High	0.32	3
	10–32	0.2–2.0	0.12–0.19	4.5–6.0	Low	High	High	0.28	
	32–60	<0.2	0.11–0.16	5.6–7.3	Low	High	High	0.43	
[1] HkD3:									
Hornell part	0–7	0.6–2.0	0.16–0.21	3.6–5.5	Low	High	High	0.43	3
	7–33	0.2–0.6	0.11–0.13	4.5–5.5	Moderate	High	High	0.28	
	33–38	<0.06	0.07–0.13	4.5–5.5	Moderate	High	High	0.17	
	38								
Fremont part	0–10	0.6–2.0	0.17–0.21	4.5–6.0	Low	High	High	0.32	3
	10–32	0.2–2.0	0.12–0.19	4.5–6.0	Low	High	High	0.28	
	32–60	<0.2	0.11–0.16	5.6–7.3	Low	High	High	0.43	
Howard:									
HoA, HoB, HoC	0–9	0.6–6.0	0.07–0.15	5.6–7.3	Low	Low	Low	0.17	3
	9–24	0.6–6.0	0.06–0.12	5.6–7.3	Low	Low	Low	0.17	
	24–45	0.6–6.0	0.05–0.08	5.6–7.3	Low	Low	Low	0.17	
	45–72	>20.	0.01–0.02	7.4–8.4	Low	Low	Low	0.17	
[1] HpD:									
Howard part	0–9	0.6–6.0	0.07–0.15	5.6–7.3	Low	Low	Low	0.17	3
	9–24	0.6–6.0	0.06–0.12	5.6–7.3	Low	Low	Low	0.17	
	24–45	0.6–6.0	0.05–0.08	5.6–7.3	Low	Low	Low	0.17	
	45–72	>20.	0.01–0.02	7.4–8.4	Low	Low	Low	0.17	
Dunkirk part	0–8	0.6–2.0	0.16–0.21	5.1–7.3	Low	Low	Low	0.49	3
	8–14	0.6–2.0	0.16–0.20	5.1–7.3	Low	Low	Low	0.43	
	14–39	0.2–0.6	0.16–0.20	5.6–7.8	Low	Low	Low	0.43	
	39–60	0.2–0.6	0.12–0.20	6.1–7.8	Low	Low	Low	0.64	
[1] HrB, HrC, HrD:									
Howard part	0–9	0.6–6.0	0.07–0.15	5.6–7.3	Low	Low	Low	0.17	3
	9–24	0.6–6.0	0.06–0.12	5.6–7.3	Low	Low	Low	0.17	
	24–45	0.6–6.0	0.05–0.08	5.6–7.3	Low	Low	Low	0.17	
	45–72	>20.	0.01–0.02	7.4–8.4	Low	Low	Low	0.17	
Madrid part	0–22	0.6–2.0	0.11–0.19	5.1–6.5	Low	Low	Moderate	0.32	3
	22–64	0.2–0.6	0.08–0.14	6.1–7.3	Low	Low	Low	0.43	
[1] HtD, HtE:									
Howard part	0–9	0.6–6.0	0.07–0.15	5.6–7.3	Low	Low	Low	0.17	3
	9–24	0.6–6.0	0.06–0.12	5.6–7.3	Low	Low	Low	0.17	
	24–45	0.6–6.0	0.05–0.08	5.6–7.3	Low	Low	Low	0.17	
	45–72	>20.	0.01–0.02	7.4–8.4	Low	Low	Low	0.17	
Alton part	0–6	2.0–6.0	0.04–0.14	4.5–5.5	Low	Low	High	0.17	3
	6–36	2.0–6.0	0.04–0.09	5.6–7.8	Low	Low	Moderate	0.17	
	36–60	>6.0	0.02–0.04	6.6–7.8	Low	Low	Low	0.17	
Kanona:									
KaA, KaB, KaD	0–8	0.2–2.0	0.14–0.19	5.6–6.5	Low	High	Moderate	0.43	3
	8–30	0.2–2.0	0.07–0.15	5.6–6.5	Moderate	High	Moderate	0.17	
	30–72	0.06–0.2	0.47–0.14	5.6–6.5	Moderate	High	Moderate	0.17	
Lackawanna:									
LaB, LaC	0–7	0.6–2.0	0.10–0.14	4.5–5.5	Low	Low	Moderate	0.17	3–2
	7–27	0.6–2.0	0.10–0.14	4.5–5.5	Low	Low	Moderate	0.28	
	27–60	0.06–0.2	0.06–0.12	4.5–6.0	Low	Low	Moderate	0.28	

TABLE 12.—*Estimated physical and chemical properties*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	*In/hr*	*In/in*	*pH*					
Lackawanna—Cont.:									
[1] LC:									
Lackawanna part	0.7	0.6–2.0	0.10–0.16	4.5–5.5	Low	Low	Moderate	0.17	3–2
	7–27	0.6–2.0	0.10–0.16	4.5–5.5	Low	Low	Moderate	0.28	
	27–60	0.06–0.2	0.06–0.12	4.5–6.0	Low	Low	Moderate	0.28	
Wellsboro part	0–7	0.6–2.0	0.10–0.14	4.5–6.0	Low	High	Moderate	0.20	3–2
	7–18	0.6–2.0	0.10–0.14	4.5–6.0	Low	High	Moderate	0.28	
	18–60	0.06–0.2	0.06–0.10	4.5–6.0	Low	High	Moderate	0.28	
Lordstown:									
LoB, LoC	0–9	0.6–2.0	0.11–0.17	4.5–5.5	Low	Low	High	0.20	3
	9–27	0.6–2.0	0.10–0.16	4.5–5.5	Low	Low	High	0.28	
	27–36	0.6–2.0	0.05–0.14	5.1–6.0	Low	Low	Moderate	0.28	
	36								
[1] LRE, LRF:									
Lordstown part	0–9	0.6–2.0	0.11–0.17	4.5–5.5	Low	Low	High	0.20	3
	9–27	0.6–2.0	0.10–0.16	4.5–5.5	Low	Low	High	0.28	
	27–36	0.6–2.0	0.05–0.14	5.1–6.0	Low	Low	Moderate	0.28	
	36								
Arnot part	0–7	0.6–2.0	0.10–0.15	4.5–6.0	Low	Low	High	0.20	2
	7–17	0.6–2.0	0.08–0.12	4.5–6.0	Low	Low	High	0.17	
	17								
Madrid:									
MaB, MaC	0–22	0.6–2.0	0.11–0.19	5.1–6.5	Low	Low	Moderate	0.32	3
	22–64	0.2–0.6	0.08–0.14	6.1–7.3	Low	Low	Low	0.43	
Mardin:									
MdB, MdC, MdD, MdD3	0–19	0.6–2.0	0.11–0.17	4.5–6.0	Low	Moderate	Moderate	0.20	3
	19–60	0.06–0.2	0.01–0.03	4.5–7.3	Low	Moderate	Moderate	0.28	
[1] MhC3:									
Mardin part	0–19	0.6–2.0	0.11–0.17	4.5–6.0	Low	Moderate	Moderate	0.20	3
	19–60	0.06–0.2	0.01–0.03	4.5–7.3	Low	Moderate	Moderate	0.28	
Ovid part	0–15	0.6–2.0	0.13–0.21	5.6–7.3	Low	High	Low	0.37	3
	15–34	0.2–0.6	0.09–0.16	5.6–7.8	Moderate	High	Low	0.28	
	34–60	0.06–0.2	0.11–0.17	7.4–8.4	Low	High	Low	0.28	
[1] MnB, MnC:									
Mardin part	0–9	0.6–2.0	0.14–0.19	4.5–6.0	Low	Moderate	Moderate	0.28	3
	9–19	0.6–2.0	0.09–0.16	4.5–6.0	Low	Moderate	Moderate	0.28	
	19–60	0.06–0.2	0.01–0.03	4.5–6.5	Low	Moderate	Moderate	0.28	
	60–70	0.06–0.2	0.15–0.20	5.1–8.4	Low	High	Low	0.64	
Volusia part	0–7	0.6–2.0	0.14–0.19	4.5–5.5	Low	High	Moderate	0.32	3
	7–15	0.6–2.0	0.09–0.16	4.5–6.0	Low	High	Moderate	0.43	
	15–46	<0.2	0.01–0.02	5.1–7.8	Low	High	Moderate	0.28	
	46–60	<0.2	0.01–0.02	5.1–7.8	Low	High	Low	0.28	
	60–70	0.06–0.2	0.15–0.20	5.1–7.8	Low	High	Low	0.64	
Middlebury:									
Mp	0–12	0.6–2.0	0.14–0.21	5.1–6.0	Low	Moderate	Moderate		
	12–41	0.6–2.0	0.10–0.20	5.6–6.5	Low	Moderate	Low		
	41–61	>6.0	0.02–0.04	5.6–6.5	Low	Moderate	Low		
Morris:									
MrB, MrC	0–15	0.6–2.0	0.12–0.16	4.5–6.0	Low	High	Moderate	0.32	3–2
	15–60	0.06–0.6	0.06–0.08	5.1–6.5	Low	High	Moderate	0.28	
MSB	0–15	0.6–2.0	0.12–0.16	4.5–6.0	Low	High	Moderate	0.24	3–2
	15–60	0.06–0.6	0.06–0.08	5.1–6.5	Low	High	Moderate	0.28	
Niagara:									
NgB	0–16	0.6–2.0	0.17–0.22	5.6–7.3	Low	High	Low	0.49	3
	16–42	0.2–0.6	0.16–0.20	5.6–7.8	Low	High	Low	0.43	
	42–60	0.2–0.6	0.12–0.20	6.6–7.8	Low	High	Low	0.64	
Ochrepts and Orthents:									
OC	0–60								

TABLE 12.—*Estimated physical and chemical properties*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	*In/hr*	*In/in*	*pH*					
Oquaga:									
OgB, OgC, OgD	0–17	0.6–2.0	0.08–0.17	4.5–5.5	Low	Low	Moderate	0.24	3
	17–32	0.6–2.0	0.04–0.12	4.5–5.5	Low	Low	Moderate	0.28	
	32								
Ovid:									
OvB, OvC	0–15	0.6–2.0	0.13–0.21	5.6–7.3	Low	High	Low	0.37	3
	15–34	0.2–0.6	0.09–0.16	5.6–7.8	Moderate	High	Low	0.28	
	34–60	0.06–0.2	0.11–0.17	7.4–8.4	Low	High	Low	0.28	
Palms:									
Pa	0–21	0.6–20	0.35–0.45	5.1–6.5		High	High		
	21–60	0.6–2.0	0.16–0.20	6.1–8.4	Low	High	Low		
Red Hook:									
Rh	0–6	0.6–2.0	0.14–0.19	5.1–6.5	Low	High	Moderate	0.49	3
	6–22	0.6–2.0	0.04–0.17	5.6–7.3	Low	High	Low	0.43	
	22–60	0.2–2.0	0.04–0.11	5.6–7.3	Low	High	Low	0.43	
Scio:									
Sc	0–9	0.6–2.0	0.18–0.21	4.5–6.0	Low	Moderate	Moderate	0.49	3
	9–42	0.6–2.0	0.17–0.20	4.5–6.0	Low	Moderate	Moderate	0.64	
	42–60	0.06–20	0.02–0.19	5.1–7.8	Low	Moderate	Moderate	0.64	
Tioga:									
Tg	0–10	0.6–2.0	0.15–0.21	5.1–6.0	Low	Low	Moderate		
	10–60	0.6–2.0	0.14–0.20	5.1–7.3	Low	Low	Low		
Tuller:									
TuB, TuC	0–6	0.6–2.0	0.09–0.15	4.5–5.5	Low	High	High	0.28	2
	6–13	0.06–0.2	0.06–0.10	4.5–6.0	Low	High	Moderate	0.28	
	13								
Unadilla:									
Un	0–8	0.6–2.0	0.18–0.21	4.5–6.0	Low	Low	Moderate	0.49	3
	8–41	0.6–2.0	0.17–0.20	4.5–6.0	Low	Low	Moderate	0.64	
	41–60	>6.0	0.01–0.04	5.1–6.5	Low	Low	Moderate	0.17	
Volusia:									
VoB, VoC, VoD	0–7	0.6–2.0	0.11–0.17	4.5–5.5	Low	High	Moderate	0.24	3
	7–15	0.6–2.0	0.09–0.16	4.5–6.0	Low	High	Moderate	0.43	
	15–46	<0.2	0.01–0.02	5.1–7.8	Low	High	Low	0.28	
	46–62	<0.2	0.01–0.02	5.1–7.8	Low	High	Low	0.28	
Wallington:									
Wa	0–3	0.6–2.0	0.19–0.21	4.5–7.3	Low	High	Moderate	0.49	3
	3–12	0.6–2.0	0.18–0.20	4.5–6.0	Low	High	Moderate	0.64	
	12–38	0.06–0.2	0.10–0.14	5.1–6.5	Low	High	Moderate	0.64	
	38–62	0.06–0.2	0.10–0.14	5.6–6.5	Low	High	Moderate	0.64	
Warners:									
We	0–13	0.2–2.0	0.17–0.22	6.1–7.8	Low	High	Low		
	13–60			7.9–8.4	Low	High	Low		
Wayland:									
Wn	0–8	0.2–2.0	0.17–0.22	6.6–7.8	Low	High	Low		
	8–47	0.06–0.2	0.16–0.20	6.6–7.8	Low	High	Low		
	47–60	0.06–0.2	0.11–0.19	7.4–8.4	Low	High	Low		
Wellsboro:									
WoB, WoC, WoD	0–7	0.6–2.0	0.10–0.14	4.5–6.0	Low	High	Moderate	0.20	3–2
	7–18	0.6–2.0	0.10–0.14	4.5–6.0	Low	High	Moderate	0.28	
	18–60	0.06–0.2	0.06–0.10	4.5–6.0	Low	High	Moderate	0.28	

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

lations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors are used in an equation that predicts the amount of erosion resulting from certain land treatment. The soil erodibility factor *K* is a measure of the susceptibility of the soil to erosion by rainfall. In table 12, soils having the highest *K* values are the most erodible. The soil-loss tolerance factor *T* is the

maximum erosion, whether from rainfall or wind, that can occur without reducing crop production or environmental quality.

Soil and water features

Features that relate to runoff or infiltration of water, to flooding, to grading and excavation, and frost action of each soil are indicated in table 13. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, by the presence of bedrock or a cemented pan in the upper 5 or 6 feet of the soil, by subsidence, or by frost action.

TABLE 13.—*Soil and water features*

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means more than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth to	Kind	Months	Depth to	Hardness	
					Ft			*In*		
Alden: Aa	D	None			0–0.5	Perched	Nov–Jun	>60		High.
Alton: AlA, AlB	A	None			>6.0			>60		Low.
Arnot: ARC	C/D	None			1.0–1.5	Perched	Apr–May	10–20	Hard	Moderate.
Atherton: At	B/D	None			0–0.5	Apparent	Nov–Jun	>60		High.
Bath: BaB, BaC, BaD, BBE.	C	None			2.0	Perched		>60	Hard	Moderate.
Braceville: BrA, BrB	C	Rare	Very brief.	Nov–Mar	0.5–3.0	Perched	Nov–Mar	>60		Moderate.
Canandaigua: Ca	D	None			0–1.0	Apparent	Nov–May	>60		High.
Canaseraga: CbB, CbC	C	None			1.5–3.0	Perched	Mar–May	>60		High.
Carlisle: Cc	A/D	Frequent	Long	Nov–May	0–1.0	Apparent	Sep–Jun	>60		High.
Chenango: Ch	A	Rare	Very brief.		3.0–6.0	Apparent	Apr–May	>60		Low.
Chippewa: Ck	D	None			0–0.5	Perched	Nov–May	>60		High.
Collamer: CoC	C	None			1.5–2.0	Apparent	Mar–May	>60		High.
Dunkirk: DuC, DuD	B	None			>6.0			>60		Low.
Edwards: Ed	B/D	Frequent	Long	Sep–May	0–0.5	Apparent	Sep–Jun	>60		High.
Fluvaquents and Ochrepts: FL	VAR	Frequent	Very brief.	Jan–Dec	0–6.0	Apparent		>60		
Fremont: FrB	C	None			0.5–1.5	Perched	Dec–May	40–60	Rippable	High.
Hornell: [1] HfB, HfC, HgD, HHE, HkD3:										
Hornell part	D	None			0.5–2.0	Perched	Dec–May	20–40	Rippable	Moderate.
Fremont part	C	None			0.5–1.5	Perched	Dec–May	40–60	Rippable	High.
Howard: HoA, HoB, HoC	A	None			>6.0			>60		Low.
[1] HpD:										
Howard part	A	None			>6.0			>60		Low.
Dunkirk part	B	None			>6.0			>60		Low.
[1] HrB, HrC, HrD:										
Howard part	A	None			>6.0			>60		Low.
Madrid part	B	None			>6.0			>60		Low.

TABLE 13.—*Soil and water features*—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth to	Kind	Months	Depth to	Hardness	
					Ft			*In*		
Howard—Cont.:										
[1] HtD, HtE:										
Howard part	A	None			>6.0			>60		Low.
Alton part	A	None			>6.0			>60		Low.
Kanona: KaA, KaB, KaD	D	None			0–1.5	Perched	Dec–Jun	>60		High.
Lackawanna: LaB, LaC	C	None			2.0	Perched	Nov–Mar	>60	Rippable	Moderate.
[1] LC:										
Lackawanna part.	C	None			2.0	Perched	Nov–Mar	>60	Rippable	Moderate.
Wellsboro part.	C	None			1.5–3.0	Perched	Nov–Mar	>60	Rippable	Moderate.
Lordstown: LoB, LoC	C	None			>6.0			20–40	Hard	Low.
[1] LRE, LRF:										
Lordstown part.	C	None			>6.0			20–40	Hard	Low.
Arnot part	C/D	None			1.0–1.5	Perched	Apr–May	10–20	Hard	Moderate.
Madrid: MaB, MaC	B	None			>6.0			>60		Low.
Mardin: MdB, MdC, MdD, MdD3.	C	None			1.5–2.0	Perched	Mar–May	>60		Moderate.
[1] MhC3:										
Mardin part	C	None			1.5–2.0	Perched	Mar–May	>60		Moderate.
Ovid part	C	None			0.5–2.0	Perched	Jan–May	>60		High.
[1] MnB, MnC:										
Marlin part	C	None			1.5–2.0	Perched	Mar–May	>60		Moderate.
Volusia part	C	None			0.5–1.5	Perched	Dec–May	>60		High.
Middlebury: Mp	B	Common			0.5–2.0	Apparent	Feb–Apr	>60		High.
Morris: MrB, MrC, MSB	C	None			0.5–1.5	Perched	Nov–Mar	>60	Rippable	High.
Niagara: NgB	C	None			0.5–1.5	Apparent	Dec–May	>60		High.
Ochrepts and Orthents: OC	VAR	None			>6.0			0–60		
Oquaga: OgB, OgC, OgD	C	None			3.0–6.0	Apparent		20–40	Hard	Low.
Ovid: OvB, OvC	C	None			0.5–2.0	Perched	Jan–May	>60		High.
Palms: Pa	A/D	Frequent	Long	Nov–May	0–1.0	Apparent	Nov–May	>60		High.
Red Hook: Rh	C				0.5–1.5	Apparent	Dec–May	>60		High.
Scio: Sc	B	None to rare.			1.5–2.0	Apparent	Mar–May	>60		High.
Tioga: Tg	B	Common			3.0–6.0	Apparent		>60		Moderate.
Tuller: TuB, TuC	D	None			0.5–1.0	Perched	Dec–Jun	10–20	Hard	High.
Unadilla: Un	B	None to rare.			>6.0			>60		Low.

TABLE 13.—*Soil and water features*—Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth to	High water table: Kind	High water table: Months	Bedrock: Depth to	Bedrock: Hard-ness	Potential frost action
					Ft			*In*		
Volusia:										
VoB, VoC, VoD	C	None			0.5–1.5	Perched	Dec–May	>60		High.
Wallington:										
Wa	C	None			0.5–1.5	Perched	Jan–Apr	>60		High.
Warners:										
We	D	Frequent	Long		0–0.5	Apparent	Nov–Jun	>60		High.
Wayland:										
Wn	D	Frequent	Long		0–0.5	Apparent	Nov–Jun	>60		High.
Wellsboro:										
WoB, WoC, WoD	C	None			1.5–3.0	Perched	Nov–Mar	>60	Rippable	Moderate.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extent of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as Fluvents at the suborder level or as fluventic subgroups. See the section "Classification of the Soils."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that show flood-prone areas at specific flood frequency levels.

A *seasonal high water table* is the highest level of a saturated zone more than 6 inches thick in soils for continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched, artesian, or apparent; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 to 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action is defined as freezing temperatures in the soil and movement of soil moisture into the freezing zone, which causes the formation of ice lenses. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Engineering test data

Table 14 contains engineering test data for some of the major soil series in Steuben County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important to earthwork. If a soil material is compacted at successively higher moisture content, assuming that

TABLE 14.—*Engineering*

[Tests performed by the New York State Department of Transportation, Soil Mechanics Bureau, in accordance with standard
no determination

Soil name and location	Parent material	Report number	Depth	Moisture density[1] Maximum	Optimum
			In	*Lb/cu ft*	*Pct*
Bath channery silt loam: Town of Wheeler, 3½ miles northeast of Avoca; 1½ miles west southwest of Wheeler. (Shallower depth to mottling than modal.)	Glacial till derived mainly from sandstone and siltstone.	3–1	0–9	98	20
		3–2	9–17	114	14
		3–3	17–21	123	12
		3–4	21–29	123	10
		3–5	29–50	126	10
Chippewa silt loam: Town of Wheeler, ½ mile northeast of Hemlock Hill school. (Surface layer has fewer coarse fragments than modal.)	Glacial till derived mainly from sandstone and shale.	1–1	0–11	88	28
		1–2	11–19	121	13
		1–3	19–38	126	10
		1–4	38–50	122	11
Fremont silt loam: Town of Howard, 1½ miles south of junction of County Route 27 and Burleson Rd, 100 feet east of Burleson Road. (Modal.)	Shaly till derived mainly from sandstone, shale, and siltstone.	5–1	0–7	97	21
		5–2	7–8	—	—
		5–3	8–28	113	16
		5–4	28–53	122	14
Howard gravelly loam: Town of Howard, 1¾ miles southwest of Howard on County Route 27 in gravel pit. (Modal.)	Glacial outwash derived mainly from limestone, sandstone and shale.	7–1	0–9	101	17
		7–2	9–19	119	12
		7–3	19–41	124	11
		7–4	41–72	138	7
Lackawanna channery silt loam: Town of West Union, 1 mile south of Wileyville on Rose Hill. (Modal.)	Glacial till derived mainly from red sandstone and shale.	9–1	0–7	102	17
		9–2	7–11	112	15
		9–3	11–17	116	14
		9–4	17–52	120	10
Scio silt loam: Town of Erwin, 1½ miles southwest of Gang Mills, 350 feet west of N.Y. Route 17. (Coarse texture at shallower depth than modal.)	Silt and very fine sand over gravel on an old stream terrace.	16–1	0–9	97	22
		16–2	9–14	104	19
		16–3	14–22	114	15
		16–4	22–35	114	13
		16–5	35–39	116	13
		16–6	39–55	129	10
Unadilla silt loam: Town of Erwin, 1 mile southwest of Village of Gang Mills. (Coarser texture in C horizon than modal.)	Stratified silt, very fine and fine sand.	14–1	0–9	108	15
		14–2	9–25	118	14
		14–3	25–54	108	13
Volusia channery silt loam, silty substratum variant: Town of Troupsburg, 1½ miles west of Troupsburg, 200 yards south of County Route 117. (C horizon is finer textured than modal.)	Sloughed till derived mainly from sandstone and shale over lacustrine silt and clay.	10–1	0–8	95	23
		10–2	8–14	112	15
		10–3	14–31	116	15
		10–4	31–50	113	16
Wallington silt loam: Town of Erwin, ¾ mile southwest of village of Gang Mills. (Has more clay than modal.)	Silt and very fine sand on old stream terrace.	15–1	0–11	96	22
		15–2	11–20	105	21
		15–3	20–27	111	16
		15–4	27–39	116	14
		15–5	39–44	116	14
Wayland silt loam: Town of Howard, 3 miles south of Howard on County Route 27, 200 yards east of County Route 27. (Modal.)	Silty alluvium.	4–1	0–8	92	24
		4–2	8–17	106	18
		4–3	17–25	110	17
		4–4	25–31	99	23
		4–5	31–47	116	13
		4–6	47–50	122	11
Wellsboro very stony silt loam: Town of West Union, ½ mile north of Wileyville. (Has more surface stones than modal.)	Glacial till derived mainly from red sandstone and shale.	8–1	0–3	—	—
		8–2	3–16	95	23
		8–3	16–25	113	15
		8–4	25–60	126	11

[1] Maximum dry density and optimum moisture based on AASHTO Designation T 99–57, Method C (*1*).

[2] Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

test data

procedures of the American Association of State Highway and Transportation Officials (AASHTO). Absence of an entry indicates was made]

Percentage passing sieve—[3]				Percentage smaller than—[3]				Liquid limit	Plasticity index	Classification	
No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO[3]	Unified[4]
								Pct			
65	58	53	51	43	25	11	6	43	9	A-5	OL
75	65	57	53	46	28	14	8	33	7	A-4	ML
68	60	53	49	42	25	11	7	21	3	A-4	GM
57	50	43	40	33	20	10	6	19	3	A-4	GM
64	57	50	47	40	26	15	10	24	6	A-4	GM-GC
100	99	98	95	83	54	27	15	37	10	A-4	CL-ML
84	78	73	68	56	26	13	9	22	7	A-4	CL
84	72	60	55	45	21	9	6	19	4	A-4	CL-ML
61	58	55	51	41	19	8	6	—	NP[5]	A-4	ML
95	92	88	82	70	46	28	18	42	13	A-7-6	ML
—	—	—	—	—	—	—	—	—	—	—	—
84	80	75	71	64	49	33	23	32	14	A-6	CL
80	70	57	50	45	30	17	11	27	9	A-4	CL
72	67	61	54	46	30	12	7	35	4	A-4	OL
28	26	22	18	15	10	6	3	25	4	A-1-b	GM-GC
26	24	17	10	9	4	3	2	25	6	A-1-b	GM-GC
27	24	12	4	3	([6])	—	—	—	NP[5]	A-1-a	GP
79	75	72	48	43	30	17	8	32	7	A-4	SM-SC
82	78	73	55	49	34	20	12	24	4	A-4	CL-ML
86	84	80	58	52	37	23	15	21	7	A-4	CL-ML
95	92	89	67	55	25	17	12	19	5	A-4	CL-ML
—	100	99	91	81	59	28	17	36	6	A-4	ML
—	100	99	90	80	55	31	19	29	6	A-4	CL-ML
—	100	99	83	70	38	23	17	22	4	A-4	ML
—	100	99	65	52	20	12	8	—	NP[5]	A-4	ML
—	100	99	67	54	22	14	11	—	NP[5]	A-4	ML
88	32	24	17	14	7	5	4	21	4	A-1-b	GM
—	100	98	83	80	49	26	16	26	5	A-4	CL-ML
—	100	99	73	61	35	22	15	20	3	A-4	ML
—	100	96	53	42	17	10	8	—	NP[5]	A-4	ML
84	81	78	69	63	46	21	14	44	11	A-7-5	OL
87	84	81	73	66	47	24	15	27	5	A-4	CL-ML
87	84	79	72	65	49	31	22	28	9	A-4	CL
93	90	87	82	76	58	37	24	30	9	A-4	CL-ML
—	100	96	92	84	66	37	23	38	11	A-6	ML
—	100	95	92	83	60	33	22	29	6	A-4	CL-ML
100	99	96	90	80	51	28	19	25	7	A-4	CL
—	100	99	80	66	32	17	12	19	1	A-4	ML
—	100	98	79	64	30	16	12	20	3	A-4	ML
—	100	99	97	85	57	35	24	42	9	A-5	OL
100	99	98	94	82	51	30	20	29	8	A-4	CL-ML
—	100	97	93	79	46	32	22	27	8	A-4	CL
100	96	91	87	76	53	36	26	40	14	A-6	CL-ML
94	93	92	87	73	38	22	15	22	6	A-4	CL-ML
87	79	74	67	54	21	10	5	21	4	A-4	ML
—	—	—	—	—	—	—	—	—	—	—	—
88	86	84	67	59	40	16	9	31	3	A-4	ML
87	85	82	64	56	39	17	11	23	6	A-4	CL-ML
72	68	63	45	39	28	17	12	20	7	A-4	GM-GC

[3] Based on AASHTO Designation M 145–49.

[4] Based on the Unified Soil Classification System A.S.T.M. Designation D2487. Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes obtained by this use is CL–ML.

[5] Nonplastic.

[6] No hydrometer analysis performed on sands of less than 10 percent passing No. 200 sieve.

Figure 10.—**A road cut exposing the stone fragments in this Bath soil. Bath soils developed in glacial till.**

the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increases in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

The tests for liquid limit and plastic limit indicate the effect of water on the strength and consistence of soil material. As the moisture content of a soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Engineering properties of geologic deposits

The following geologic deposits occur in Steuben County: glacial till, outwash, kame, lacustrine, alluvial, and organic. The engineering significance of each geologic deposit is influenced to a great extent by its mode of deposition which in turn determines the texture of the material and the internal structure. Other influences are the position in the landscape and position of the water table. In Steuben County the geologic deposits may be divided into the following categories: deep till deposits, shallow till deposits, stratified coarse-grained deposits, stratified fine-grained deposits, and organic deposits.

DEEP TILL DEPOSITS

Deep till deposits consists of thick, unstratified, highly variable mixtures of all particle sizes ranging from rock fragments to clay (fig. 10). These deposits were scoured and transported by glacial ice from nearby sources and deposited as ground moraine and recessioned moraines. Lenses or pockets of sorted material are isolated in places, especially in the recessioned moraine deposits. Bedrock is generally more than 5 feet beneath the surface of the soil, but there are some shallower soils or rock outcrops in places. The individual rock and mineral fragments in the soil generally reflect the kinds of bedrock in the area.

Alden, Bath, Chippewa, Fremont, Kanona, Lackawanna, Madrid, Mardin, Morris, Volusia, and Wellsboro soils formed in these nonsorted, nonstratified glacial till deposits. Canaseraga and Ovid soils formed in reworked assorted fine-grained material that is underlain by glacial till at depths of 15 to 34 inches.

These soils are the most dense and compact of the unconsolidated deposits in the county. Most of the till deposits have been subjected to the compactive weight of overriding ice. Except for the poorly drained and very poorly drained soils, very few soils that formed in this heterogeneous material are level. Most are gently sloping to very steep, and cut and fill earthwork is necessary at most construction sites. The soils provide stable, imcompressible foundations for engineering works. If properly compacted, fill material from these deposits generally provides stable embankments. Cut slopes often are subject to surface sloughing and erosion.

SHALLOW TILL DEPOSITS

Shallow till deposits consist of unstratified mixtures of material that was transported by glaciers and deposited as a thin veneer over bedrock. The till is generally 1 foot to 3 feet thick and has Rock outcrops common to some areas. The bedrock generally controls landforms and topography.

Lordstown and Tuller soils formed in till over sandstone and siltstone. Arnot soils formed in shallow till over sandstone, siltstone, and shale. Oquaga soils

formed over sandstone and shale. Hornell soils formed over shale. Ochrepts and Orthents occur on very steep ravines where the deeply entrenched stream has generally reached bedrock.

Soils that formed in shallow till deposits generally have adequate strength for foundations of light structures, but the underlying bedrock and ground water conditions are the primary engineering concerns. In places cut and fill earthwork is necessary for extensive engineering works. Special care should be taken on Ochrepts and Orthents soils because in many places the unconsolidated soil material is unstable and susceptible to sliding or rapid mass movement.

The shale bedrock generally is softer and more deeply weathered than the siltstone and sandstone, but in places harder lenses occur. Fill material is limited in quantity because of the closeness of bedrock.

STRATIFIED COARSE-GRAINED DEPOSITS

Stratified coarse-grained deposits consist mainly of gravel and sand that were sorted by glacial melt water into layered or stratified deposits (fig. 11). These deposits are on outwash plains and terraces, kame terraces, alluvial fans, and flood plains. They have strata that are either well sorted or poorly sorted and are of soil-particle size ranging from cobbles to silt.

Alton, Atherton, Braceville, Howard, and Red Hook soils formed in gravelly deposits of outwash, kames, and water-sorted morainal material. Scio and Unadilla soils formed in assorted fine-grained material underlain by sand and gravel. Chenango soils occur on alluvial fan deposits. Middlebury, Tioga Fluvaquents, and Ochrepts soils are on flood plains. These soils are subject to flooding.

Coarse-grained deposits generally have high strength. Because of their loose and porous nature, most of these deposits are not highly erodible, but they tend to settle when agitated. The silty and fine sandy mantle of Scio and Unadilla soils, however, is susceptible to erosion.

These deposits of gravel and sand have many uses as construction material. Depending on gradation, soundness, and plasticity, the deposits can be used for: fill material for highway embankments, parking areas, and

Figure 11.—**This gravel pit in Howard soils shows stratified layers of sand and gravel.**

housing developments; fill material to lessen stress on underlying soils so construction operations can progress; subbase for pavements; wearing surfaces for driveways, parking lots, and some roads; highway shoulders; free draining backfill for structures and pipes; outside shells of dams for impounding water; slope blankets that protect, drain, and help stabilize wet cut slopes; and sources of sand and gravel for general use.

STRATIFIED FINE-GRAINED DEPOSITS

Stratified fine-grained deposits consist of lacustrine fine-grained sediment that was transported by glacial melt water and deposited in quiet glacial lakes and ponds. Some of these deposits are in bodies of water associated with the recessional moraines, and some are flood-plain deposits from slack-water environments. These deposits are mostly silt and fine sand and have very little clay.

Collamer and Dunkirk soils formed in silty material on moraines. Canandaigua, Niagara, and Wallington soils formed in deep, silty areas of lacustrine shore deposits. Mardin and Volusia soils that have a silty substratum formed in glacial till underlain by silty lake-laid material. Wayland soils formed in alluvial sediments on flood plains.

Because of their fine texture and content of moisture, these deposits have low strength. They are generally highly compressible, and they settle in places over long periods. The deposits are highly erodible and susceptible to frost. Wayland soils are subject to flooding. Mardin and Volusia soils that have a silty substratum tend to be unstable because stream erosion undercuts the banks. Sites for high fills and heavy structures or buildings on all soils that formed in these finer sediments must be investigated for strength, settlement characteristics and effects of ground water.

ORGANIC DEPOSITS

Organic deposits consist mainly of an accumulation of plant and animal remains and in places include a minimal amount of mineral soil. These deposits are in very poorly drained depressions and bogs.

Carlisle, Edwards, and Warners soils are over marl at various depths; Palms soil is over mineral soil at various depths. These soils are unsuitable for foundations because they are very weak and highly compressible. Generally, the organic material should be removed down to suitable underlying material and placed with suitable backfill. In such filled areas, settling occurs for long periods.

Formation, Morphology, and Classification of the Soils

This section discusses the major factors that affect the formation and morphology of the soils of Steuben County and classifies the soils by higher categories.

Factors of Soil Formation

Soils are formed through the interaction of five major factors. They are: climate, plant and animal life, parent material, relief, and time. The relative influence of each factor generally varies from place to place. Local variations in soils are a result of differences in the kind of parent material and in topography and drainage. In places, one factor dominates the formation of a soil and determines most of its properties.

Climate

The climate of Steuben County is temperature continental and is marked by extreme seasonal temperature changes. Annual precipitation varies from 31 to 36 inches, and the mean annual air temperature is about 47°F. The rainfall is uniform during the growing season, May through September; it averages 16 to 17 inches. The cool temperature has promoted the accumulation of organic matter in the surface layers of the soils. For more detailed information on climate, see the "Climate" subsection in the section "General Nature of the County."

Plant and animal life

All living organisms are important in soil formation. These include vegetation, animals, bacteria, and fungi. The vegetation is generally responsible for the amount of organic matter, color of the surface layer, and the amount of nutrients. Earthworms and other burrowing animals help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plant food. In Steuben County, the native forests have had more influence on soil formation than any other living organism. The root zone is shallow in many of the soils, and this shallowness has caused a succession of tree-throws that have kept much of the soil material churned up to a depth of 18 inches. Man has greatly affected the surface layer by clearing the forests and plowing the land. He has added fertilizer, mixed some of the soil horizons, and moved soil material from place to place.

Parent material

Parent material is the unconsolidated mass from which soils are formed. It also determines the mineralogical and chemical composition of the soil and to a large extent the rate that soil-forming processes take place.

In Steuben County, soil formed in glacial till, glacial outwash, lacustrine material, recent stream alluvium, and organic material. Most of the soil material was left after the glaciers melted 10,000 to 15,000 years ago. Alluvial and organic materials are of recent origin and are being deposited at the present time. Soils that formed from glacial till are the most extensive and have a wide range of characteristics. Firm substrata are commonly present. Mardin, Volusia, and Chippewa soils are a few examples. Soils that formed from glacial outwash deposits are commonly underlain by stratified sand and gravel, for example, Howard soils. Soils that formed in lacustrine material contain few or no coarse fragments and have a high content of stratified silt and very fine sand, for example Dunkirk and Niagara soils. Soils on stream bottoms are formed from water-laid material called recent alluvium. They generally are medium textured and have little soil

development, for example, Tioga and Wayland soils. Soils that formed from organic material are called muck soils, for example Carlisle, Edwards, and Palms soils.

Table 15 shows the relationship between soil series in Steuben County and position, parent material, and natural drainage.

Relief

The shape of the land surface, the slope, and the position in relation to the water table have had a great influence on the formation of soils in the county. Soils that formed on sloping areas where runoff is moderate to rapid generally have a bright-colored unmottled subsoil, and in most places they are leached to greater depths than wetter soils in the same general area. In most gently sloping areas where runoff is slower, the soils generally exhibit some evidence of wetness, for example, mottling in the subsoil. In level areas or slight depressions where the water table is at or near the surface for long periods, the soils show evidence of wetness to a marked degree. They have a dark-colored, thick, organic surface layer and a strongly mottled or grayish subsoil. Some soils are wet because of either a high ground-water table or accumulated water that is perched on impervious layers in the soil. Permeability of the soil material and the length, steepness, and shape of the slopes influence soil formation from place to place. Local differences in soils are mainly the result of differences in parent material and topography.

Time

The formation of soils requires a long time when measured in years. The soils of Steuben County formed in the period after glaciation. Evidence of this relatively short formation time can be seen in the soils.

Soils that formed on low bottoms that are subject to flooding receive new sediment with each flooding. These soils have weak structure and little color difference between horizons, for example, Tioga soil. Soils that have well developed horizons, for example, Howard soils, have been developing for longer periods than Tioga soils.

Morphology of Soils

In this subsection, horizons and their nomeclature are briefly described. The processes that are involved in the way a horizon forms are also described and explained.

Major soil horizons

The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, that are seen in a soil profile. The soil profile extends from the surface of the land down to material that is little altered by the soil-forming processes.

Most soils contain three major horizons, which are the A, B, and C horizons. These major horizons may be further subdivided by the use of numbers and letters to indicate changes within one horizon. An example would be the B2t horizon, which represents a B horizon that has an accumulation of clay.

The A horizon is the surface layer. An A1 horizon is that part of the surface layer that has the largest accumulation of organic matter. The A horizon is also the layer of maximum leaching or eluviation of clay and iron. If the soil has been considerably leached and organic matter has not darkened the material, the horizon is called the A2 horizon. In some soils in Steuben County, the A2 horizon is brownish in color because of the oxidation of iron.

The B horizon underlies the A horizon and is commonly called the subsoil. It is the horizon and maximum accumulation or illuviation of clay, iron, aluminum, or other compounds that are leached from the surface layer. In some soils, the B horizon is formed by alteration in place rather than by illuviation. The alteration may be caused by oxidation and reduction of iron or by the weathering of clay minerals. The B horizon commonly has blocky or prismatic structure and is firmer and lighter colored than the A1 horizon, but it is darker colored than the C horizon.

The C horizon is below the A or B horizon. It consists of material that is little altered by the soil-forming processes, but this material is modified by weathering in places.

Processes of soil horizon differentiation

In Steuben County several processes are involved in the formation of soil horizons. Among these are the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes continually take place, generally at the same time throughout the profile, and have been going on for thousands of years.

The accumulation and incorporation of organic matter coincide with the decomposition of plant residue that darkens the surface layer and helps to form the A1 horizon. Once organic matter is lost, generally a long time is needed to replace it. In Steuben County the organic matter content of the surface layer averages about 4 percent.

For soils to have a distinct subsoil, presumably some of the lime and other soluble salts are leached before the translocation of clay minerals. This leaching is affected by the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Well drained and moderately well drained soils in Steuben County have a yellowish brown or reddish brown subsoil horizon. These colors are caused mainly by thin coatings of iron oxides on sand and silt grains, but in some soils the colors are inherited from the reddish glacial material in which they formed, for example, the Lackawanna soils.

A fragipan has developed in the subsoil of some of the moderately well drained and somewhat poorly drained soils, for example, Mardin and Volusia soils. These horizons are very firm and brittle when moist and very hard when dry. Soil particles are tightly packed so that bulk density is high and pore space is low. The origin of these horizons is not fully understood, but studies show that swelling and shrinking

TABLE 15.—*Relationship between soil series and position, parent material, and natural drainage*

Parent material	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
	SOILS ON UPLANDS					
Moderately deep, medium textured, brownish colored glacial till.		Lordstown				
Moderately deep, medium textured, reddish colored glacial till.		Oquaga				
Shallow, medium textured glacial till		Arnot	Arnot	Tuller	Tuller	
Moderately deep, fine textured glacial till				Hornell		
Deep, moderately coarse textured glacial till.		Madrid				Alden
Deep, moderately fine textured, alkaline glacial till.			Ovid	Ovid		
Deep, moderately fine textured, acid glacial till.				Fremont		
Deep, fine textured glacial till				Kanona	Kanona	
Deep, medium textured, compact, brownish colored glacial till.		Bath	Mardin	Volusia	Chippewa	
Deep, medium textured, compact, reddish colored glacial till.		Lackawanna	Wellsboro	Morris		
Deep, silt mantled, compact glacial till		Canaseraga	Canaseraga			
	SOILS ON OUTWASH TERRACES AND FANS					
Stratified sand and gravel, mainly acid, loamy material.	Chenango	Chenango		Red Hook	Atherton	Atherton
Stratified sand and gravel, mainly alkaline, loamy material.	Howard	Howard				
Stratified sand and gravel, mainly sandy material.	Alton	Alton				
Stratified sand and gravel, compact, loamy material.			Braceville			
	SOILS ON LACUSTRINE PLAINS					
Silty, alkaline sediments		Dunkirk	Collamer	Niagara	Canandaigua	
Silty, acid sediments		Unadilla	Scio	Wallington		
	SOILS ON FLOODPLAINS					
Medium textured alluvial sediments		Tiogo	Middlebury	Middlebury	Wayland	Wayland
Mineral sediments from 12 to 20 inches thick over marl deposits.						Warners
	SOILS ON SWAMPS AND BOGS					
Deep organic material						Carlisle
Organic material from 16 to 50 inches thick over mineral deposits.						Palms
Organic material from 16 to 40 inches thick over marl deposits.						Edwards

takes place in alternating wet and dry periods. This may account for the packing of soil particles and also for a gross polygonal pattern of cracks in the fragipan. Clay, silica, and oxides of aluminum are the most likely cementing agents causing brittleness and hardness.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils; this process is called gleying. Moderately well drained to somewhat poorly drained soils have mottles of yellowish brown and reddish brown, indicating that iron is segregated. In poorly drained to very poorly drained soils, for example, the Alden, Canandaigua, and Chippewa soils, the subsoil and underlying material are grayish colored, which indicates that iron was reduced and transfered when it was removed in solution.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*11*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. The classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming

TABLE 16.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alden	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts.
Alton	Loamy-skeletal, mixed, mesic Dystric Eutrochrepts.
Arnot	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts.
Atherton	Fine-loamy, mixed, nonacid, mesic Aeric Haplaquepts.
Bath	Coarse-loamy, mixed, mesic Typic Fragiochrepts.
Braceville	Coarse-loamy, mixed, mesic Typic Fragiochrepts.
Canandaigua	Fine-silty, mixed, nonacid, mesic Mollic Haplaquepts.
Canaseraga	Coarse-silty, mixed, mesic Typic Fragiochrepts.
Carlisle	Euic, mesic Typic Medisaprists.
Chenango	Loamy-skeletal, mixed, mesic Typic Dystrochrepts.
Chippewa	Fine-loamy, mixed, mesic Typic Fragiaquepts.
Collamer	Fine-silty, mixed, mesic Glossoboric Hapludalfs.
Dunkirk	Fine-silty, mixed, mesic Glossoboric Hapludalfs.
Edwards	Marly, euic, mesic Limnic Medisaprists.
Fluvaquents and Ochrepts	Fluvaquents and Ochrepts.
Fremont	Fine-loamy, mixed, acid, mesic Aeric Haplaquepts.
Hornell	Fine, illitic, acid, mesic Aeric Haplaquepts.
Howard	Loamy-skeletal, mixed, mesic Glossoboric Hapludalfs.
Kanona	Fine, illitic, nonacid, mesic Aeric Haplaquepts.
Lackawanna	Coarse-loamy, mixed, mesic Typic Fragiochrepts.
*Lordstown	Coarse-loamy, mixed, mesic Typic Dystrochrepts.
Madrid	Coarse-loamy, mixed, mesic Glossoboric Hapludalfs.
Mardin	Coarse-loamy, mixed, mesic Typic Fragiochrepts.
Middlebury	Coarse-loamy, mixed, mesic Fluvaquentic Eutrochrepts.
Morris	Coarse-loamy, mixed, mesic Aeric Fragiaquepts.
Niagara	Fine-silty, mixed, mesic Aeric Ochraqualfs.
Ochrepts and Orthents	Ochrepts and Orthents.
Oquaga	Loamy-skeletal, mixed, mesic Typic Dystrochrepts.
Ovid	Fine-loamy, mixed, mesic Aeric Ochraqualfs.
Palms	Loamy, mixed, euic, mesic Terric Medisaprists.
Red Hook	Coarse-loamy, mixed, acid, mesic Aeric Haplaquepts.
Scio	Coarse-silty, mixed, mesic Aquic Dystrochrepts.
Tioga	Coarse-loamy, mixed, mesic Dystric Fluventic Eutrochrepts.
Tuller	Loamy-skeletal, mixed, acid, mesic Lithic Haplaquepts.
Unadilla	Coarse-silty, mixed, mesic Typic Dystrachrepts.
Volusia	Fine-loamy, mixed, mesic Aeric Fragiaquepts.
Wallington	Coarse-silty, mixed, mesic Aeric Fragiaquepts.
Warners	Fine-silty, carbonatic, mesic Fluvaquentic Haplaquolls.
Wayland	Fine-silty, mixed, nonacid, mesic Mollic Fluvaquents.
Wellsboro	Coarse-loamy, mixed, mesic Typic Fragiochrepts.

* Lordstown soils are taxadjuncts to the series. They are outside the defined range for the series because they dominantly have 35 to 45 percent coarse fragments rather than less than 35 percent as defined for the series.

processes that have taken place. Each order is identified by a word ending in *sol.* An example is Inceptisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ochrept (*Ochr*, meaning a surface horizon that is either light in color or low in organic matter, or both, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Dystrochrepts (*Dystr*, meaning low base saturation, plus *ochrept*, the suborder of Inceptisols).

SUBGROUP. Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Dystrochrepts.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-silty, mixed, mesic Typic Dystrochrepts.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

General Nature of the County

This section provides information about the environment of Steuben County affecting or related to soil use. It discusses climate; physiography and geology; drainage; water supply; settlement and population; farming; and transportation and industries.

Climate [7]

Steuben County has a temperate, continental climate that is governed mainly by air masses and weather systems that originate over the land areas of the North American continent. Cold, dry weather prevails when the air flow comes from the northwest and warm, occasionally humid weather prevails when winds come from the south or southwest. Air masses that originate over the ocean play a secondary role in the climate. Occasionally an easterly flow of air from the North Atlantic Ocean develops, and cloudy, damp, and moderately cool weather will prevail.

Summers are pleasantly warm; the temperatures are moderated when cool, dry air from the higher latitudes of the continent frequently invade. Winters are long and quite cold, characterized by considerable cloudiness and extended periods of stormy, unsettled weather.

There is generally much precipitation throughout the year. Precipitation ranges from a minimum of about 2 inches per month in winter to 4 inches per month late in spring and summer.

When atmospheric pressure systems move to the northeastern United States, temperature, humidity, wind, and other weather characteristics noticeably change in a few days. The weather one week often differs from that of the preceding week; however, in some periods of many days the weather changes very little. The seasonal weather varies appreciably from year to year.

Topography is important to the climate because of the many river and stream valleys in the predominantly hilly terrain. Features of the terrain or changes in elevation and the degree and aspect of slope can significantly affect the temperature and other climatic conditions within short distances.

The Great Lakes do not have a continuing, direct effect on the climate because they are too far away from the county. But, air flow across the lakes in winter can extend cloudiness and bring frequent periods of snow flurries. This cloudiness can also moderate generally cold temperatures at night.

Temperatures of 90°F. or higher can occur in 10 to 15 days each year in the lower valleys but only in 3 to 5 days in higher areas. The maximum daytime temperature in summer usually ranges from the upper seventies to the middle eighties. A below zero temperature is recorded on 6 to 12 days in most winters. A range of –5° to –20°F. can be expected in the majority of winters, but extreme temperatures of –25° to –30°F. have been recorded.

The average length of the freeze-free growing season in Steuben County is 140 to 145 days in the northeast, 115 to 120 days in the southwest, and 135 to 140 days in the major river valleys. In about 1 year out of 10, a temperature of 32°F. or colder can occur in spring as late as June 1 and in autumn as early as September 15.

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[7] By BOYD PACK, PHD, senior research associate, Division of Atmospheric Sciences, Department of Agronomy, Cornell University, Ithaca, New York.

Annual precipitation ranges from 31 to 36 inches. In places that are 1,500 feet or higher the average annual precipitation is 35 to 36 inches per year, and in those places in the major river valleys it is about 31 inches. The rainfall in the growing season, which is from May through September, is 16 to 17 inches. The quantity and distribution of the rainfall generally are adequate for agriculture, home gardens, and the maintenance of water resources. Long periods of drought are rare, but a lack of rainfall and soil moisture for short periods is common in most growing seasons.

Snowfall varies greatly in the county. In the western and north-central sections the average seasonal precipitation is 70 to 75 inches, but in the eastern third of the county the average season precipitation is 50 to 55 inches. Monthly totals of 8 to 20 inches are common from December to March. Snow cover is measurable for about 3 months each winter.

The sun shines about 30 percent of the time in November and December and about 60 to 65 percent in June through September.

Table 17 gives data on temperature and precipitation for Steuben County. Table 18 shows probable dates of first freeze in fall and last freeze in spring.

Physiography and Geology [8]

Steuben County is in the Allegheny Plateau physiographic province. There is significant relief in the county; the highest elevation is 2,400 feet above sea level, and the lowest is 714 feet above sea level at Keuka Lake.

The plateau itself is mature and eroded; the dissecting streams create valleys that are as deep as 300 to 600 feet. The most important of the main valleys are those that contain the Canisteo and Cohocton Rivers. These rivers cut the county in a northwest to southeast direction and merge at the village of Painted Post to form the Chemung River Valley. Just upstream from this junction the Tioga River Valley merges with the Canisteo Valley.

The Canisteo and Tioga Valleys are about a mile wide. Most of the main valleys were widened by moving glacial ice that was trapped in the valleys during glacial periods. Side slopes on most valleys rise steeply from the valley floor for about half a mile and then

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TABLE 17.—*Temperature and precipitation data*

[Data are from Addison, New York, 1941–70]

Month	Temperature				Precipitation				
			7 years in 10 will have—			3 years in 10 will have—		Snowfall	
	Average daily minimum	Average daily maximum	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—	Average monthly total	More than—	Less than—	Average monthly total	7 years in 10 will have more than—
	F	*F*	*F*	*F*	*In*	*In*	*In*	*In*	*In*
January	33	15	46	−2	2.0	2.7	1.4	11	5
February	35	16	51	−2	1.9	2.5	1.2	12	7
March	44	23	63	9	2.7	3.2	2.1	11	8
April	59	34	78	22	3.2	3.7	2.5	3	4 (1)
May	70	43	85	29	3.7	4.3	2.7	(2)	0
June	79	52	90	39	3.3	4.2	2.2	0	0
July	82	57	91	45	4.1	4.5	3.6	0	0
August	80	55	89	42	3.1	3.6	2.2	0	0
September	74	48	87	34	2.6	3.2	2.0	0	0
October	64	38	80	25	2.6	2.8	1.4	(2)	(1), (2)
November	49	30	66	16	2.8	3.4	1.8	5	1
December	36	20	52	0	2.4	3.1	1.5	12	6
Year	59	36	93	−11	34.4	36.0	31.5	54	44

[1] 2 years in 10.
[2] Trace.

TABLE 18.—*Freeze dates in spring and fall*

[Data are from Addison, New York, 1941–70]

Probability	Temperature				
	32 F or lower	28 F or lower	24 F or lower	20 F or lower	16 F or lower
Average date last spring occurrence	May 16	May 3	Apr. 17	Apr. 4	Mar. 23
Average date first fall occurrence	Sep. 30	Oct. 12	Oct. 24	Nov. 9	Nov. 22

continue rising at a decreasing rate to areas of maximum elevation. The areas between the valleys consist of rolling uplands and some flat-topped hills that formed partly because of the nearly horizontal bedding of the underlying bedrock.

All of the bedrock (fig. 12) in Steuben County is of Devonian age and formed generally from deltaic deposits. During late Devonian time the large Catskill Delta advanced westward from an area of accumulation in east-central Pennsylvania (*5*). Most of the beds formed broad open folds that trend to the northeast and are about 5 to 10 miles apart (*4*). The Sonyea Formation, which is the oldest rock formation, in the county, is in a small area around Keuka Lake in the northeast. This formation is subdivided into four members (*3*), which are mainly siltstones and shales.

The West Falls Formation, which is the second oldest rock formation in the county, is in a large area in the northeastern part of the county. This formation has seven members, which are predominantly sandstone, shale, and siltstone. The Hanover and Wiscoy Formation, which is the third oldest, outcrops in a narrow band just above the West Falls Formation, and scattered areas of this formation outcrop in the West Falls Formation in the northern part of the county. The Perrysburg Formation, which is the fourth oldest, outcrops in a large diagonal pattern that runs southeast to northwest in the central part of the country.

The youngest rock formations in the county are the Conneaut and Canadaway Formations in the southwest corner of the county; they are mainly shales, sandstones, and siltstones.

Steuben County went through several glacial advances and retreats during the Pleistocene Age. The ice picked up soil material and pieces of bedrock in each southward movement and ultimately redeposited a mixture of unconsolidated mineral material of various sizes and shapes. The last advance stripped earlier deposits and laid down the present mantle on which most of the soils formed.

Two different glacial drifts are found within the county. The Olean substage of the Wisconsin glaciation is the drift that covers most of the county. The drift is thin and patchy and is made up of relatively soft sandstones, siltstones, and shales. It commonly has a low calcium carbonate content and is deeply leached. The Valley Heads moraine of Fairchild covers the northeast corner of the county around Keuka Lake. This is a thick drift that contains a considerable amount of somewhat resistant sedimentary and crystalline rock. It commonly has a relatively high carbonate content and is leached to only shallow depths. The Valley Heads is younger than the Olean.

Various types of material resulted from the several modes of deposition that occurred either during or shortly after the glacial retreat. Basically, three types

Figure 12.—A road cut exposing the bedrock that underlies Lordstown soils.

of glacial materials were deposited in the county: till, lacustrine or lake-laid, and outwash material.

The main glacial deposit in the county is till. This material usually results from debris that is deposited beneath a moving glacier. The makeup of the till is influenced by local bedrock over which the glacier has moved and picked up particles. Bath and Mardin are examples of soils that formed in glacial till.

Outwash deposits are material that washed out from under or around a melting glacier. These deposits are scattered throughout the county. Howard soils are typical of the soils that formed in the outwash deposits.

With glacial retreat and the subsequent large amounts of melt water, numerous lakes developed in various locations. Frequently, those lakes developed because ice or drift material plugged outwater channels. Generally, these lacustrine or lake-laid deposits in the county are younger than the glacial till deposits. Soils that formed in these lacustrine deposits are fine grained, for example, Dunkirk soils.

After the ice retreated, recent deposits were formed. These deposits are found in the flood plains of major streams and on fans at the base of some hill slopes. They are called alluvial deposits and were transported by water. The finer grained materials are associated with deposits that occur during overbank flow in periods of flooding in the main valley. Middlebury soils are an example of soils that formed in recent alluvial deposits.

Drainage

Most of Steuben County is in the Susquehanna River watershed. The northeast, northwest, and southwest fringes of the county, however, drain ultimately into Lake Ontario and out through the St. Lawrence River. The northwest and southwest areas drain through the Genesee River, and the northeast area drains through Keuka and Seneca Lakes and the Seneca River. The Canisteo and Cohocton Rivers and their tributaries drain most of the interior part of the county and ultimately enter the Susquehanna River through the Chemung River.

Water Supply

The principal source of water for domestic use in the rural sections of the county is dug or drilled wells. These wells generally are adequate, but in dry periods lasting more that 3 weeks in midsummer many of the shallow dug wells go dry. Springs are also quite common; many flow all year and supply running water to farms. Most communities obtain water from developed springs, drilled wells that are 30 to 250 feet deep, or constructed reservoirs.

Settlement and Population

The Seneca Indians were the first inhabitants of the area that is now Steuben County. Others settled in the area in 1786 on the present site of Painted Post.

The county was formed from Ontario County in 1796 and was named in honor of Baron von Steuben, the Revolutionary War hero. Other early settlements were Bath, Canisteo, and Corning.

The Chemung River provided the earliest means of transportation. Rail service was established about 1850.

The population of the county rose sharply because of settlers moving in from the east and south. The population has increased from about 64,000 in 1850 to 83,000 in 1930; 91,000 in 1950; and 99,546 in 1970.

Bath is the largest village and the county seat. In 1970, it had a population of 6,053; the cities of Corning and Hornell had 15,792 and 12,144 residents.

Farming

The 1969 Census of Agriculture shows that 51 percent or 456,957 acres of Steuben County is in farms. Dairying is the chief type of farming.

The number of farms in the county has steadily declined from 3,219 in 1954 to 1,799 in 1969, but the average size of farms has increased during this same period from 187 acres to 254 acres each.

Prior to 1930 a wide variety of grain and vegetable crops were grown. In recent years only grain and forage used in dairying, dry beans, grapes, and potatoes have been a significant part of the agriculture of the county.

In 1969, crop production included 21,786 acres of alfalfa; 18,950 acres of field corn; 23,242 acres of oats; 4,991 acres of wheat; 9,858 acres of potatoes; and 2,773 acres of grapes.

The number of cattle and calves was 54,433, of which slightly less than half were milk cows. Poultry, sheep, and swine are also produced in the county, but on a much smaller scale.

Transportation and Industries

U.S. Highway 15 connects Steuben County to regions of the north and south. State Highway 17 is a divided, limited access highway that connects the county to regions of the east and west.

The main line of the Erie-Lackawanna Railroad passes through the middle of the county. At Hornell, it branches in a westerly direction. A local spur extends from Corning to Wayland. The Penn-Central Railroad crosses the southeast corner of the county through the city of Corning.

Commercial airline service is available at the Chemung County Airport near the eastern edge of the county and at Rochester to the north.

The county has many industries, including the manufacture of glass products, compressors, sheet metal products, bearing housings, textiles, furniture, electronic parts, and paper and wood products. Wine and champagne are produced near Hammondsport. Dairy products, potatoes, and grain crops are shipped to various locations in the eastern part of the country.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent silt.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour tillage. Performing the tillage operations and planting on the contour within a given tolerance.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Illite. A hydrous mica.

Illuviation. The process of deposition of soil material removed from one horizon to another in the soil; usually from an upper to a lower horizon in the soil profile.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strong acid	4.5 to 5.0	Moderately alkaline	6.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till. Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable. hard, nonaggregated, and difficult to till.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within 1 year; specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read the description of the mapping unit and that of the soil series to which the mapping unit belongs.

Map symbol	Mapping unit	Described on page	Capability subclass Symbol	Woodland subclass Number
Aa	Alden silt loam	12	IVw	5w
AlA	Alton gravelly fine sandy loam, 0 to 3 percent slopes	12	IIs	3o
AlB	Alton gravelly fine sandy loam, undulating	12	IIs	3o
ARC	Arnot channery silt loam, 2 to 20 percent slopes	13	IVe	4d
At	Atherton silt loam	14	IVw	4w
BaB	Bath channery silt loam, 3 to 12 percent slopes	15	IIe	3o
BaC	Bath channery silt loam, 12 to 20 percent slopes	15	IIIe	3r
BaD	Bath channery silt loam, 20 to 30 percent slopes	15	IVe	3r
BBE	Bath soils, steep	15	VIe	3r
BrA	Braceville gravelly silt loam, 0 to 3 percent slopes	16	IIw	2o
BrB	Braceville gravelly silt loam, 3 to 8 percent slopes	16	IIw	2o
Ca	Canandaigua silt loam	17	IIIw	4w
CbB	Canaseraga silt loam, 2 to 6 percent slopes	17	IIe	2o
CbC	Canaseraga silt loam, 6 to 12 percent slopes	18	IIIe	2r
Cc	Carlisle muck	18	IIIw	5w
Ch	Chenango channery silt loam, fan	19	IIs	3o
Ck	Chippewa channery silt loam	20	IVw	5w
CoC	Collamer silt loam, rolling	21	IIIe	2r
DuC	Dunkirk silt loam, rolling	21	IIIe	2r
DuD	Dunkirk silt loam, hilly	21	IVe	2r
Ed	Edwards muck	22	IVw	4w
FL	Fluvaquents and Ochrepts	22	Vw	------
FrB	Fremont silt loam, 2 to 8 percent slopes	23	IIIw	3w
HfB	Hornell-Fremont silt loams, 1 to 6 percent slopes	23	IIIw	3w
HfC	Hornell-Fremont silt loams, 6 to 12 percent slopes	24	IIIe	3w
HgD	Hornell and Fremont silt loams, 12 to 20 percent slopes	24	IVe	------
	Hornell part	------	------	3w
	Fremont part	------	------	3r
HHE	Hornell and Fremont silt loams, steep	24	VIIe	3r
HkD3	Hornell and Fremont silty clay loams, 6 to 20 percent slopes, severely eroded	24	VIe	3r
HoA	Howard gravelly loam, 0 to 3 percent slopes	25	IIs	2o
HoB	Howard gravelly loam, undulating	25	IIs	2o
HoC	Howard gravelly loam, rolling	25	IVe	2r
HpD	Howard-Dunkirk complex, hilly	25	IVe	2r
HrB	Howard-Madrid complex, undulating	26	IIs	2o
HrC	Howard-Madrid complex, rolling	26	IVe	2r
HrD	Howard-Madrid complex, 20 to 30 percent slopes	26	IVe	2r
HtD	Howard and Alton gravelly soils, 20 to 30 percent slopes	26	IVe	------
	Howard part	------	------	2r
	Alton part	------	------	3r
HtE	Howard and Alton gravelly soils, 30 to 45 percent slopes	27	VIIe	------
	Howard part	------	------	2r
	Alton part	------	------	3r
KaA	Kanona silty clay loam, 0 to 2 percent slopes	27	IVw	5w
KaB	Kanona silty clay loam, 2 to 6 percent slopes	27	IVw	5w
KaD	Kanona silty clay loam, 6 to 20 percent slopes	27	IVw	5w
LaB	Lackawanna channery silt loam, 3 to 12 percent slopes	28	IIe	3o
LaC	Lackawanna channery silt loam, 12 to 20 percent slopes	28	IVe	3r
LC	Lackawanna-Wellsboro association, extremely stony	28	VIIs	------
	Lackawanna part	------	------	3x
	Wellsboro part	------	------	2x
LoB	Lordstown channery silt loam, 3 to 12 percent slopes	29	IIe	3o
LoC	Lordstown channery silt loam, 12 to 20 percent slopes	29	IVe	3r

Map symbol	Mapping unit	Described on page	Capability subclass Symbol	Woodland subclass Number
LRE	Lordstown-Arnot association, steep	29	VIIs	------
	Lordstown part	------	------	3r
	Arnot part	------	------	4r
LRF	Lordstown-Arnot association, very steep	30	VIIs	------
	Lordstown part	------	------	3r
	Arnot part	------	------	4r
MaB	Madrid fine sandy loam, undulating	30	IIe	2o
MaC	Madrid fine sandy loam, rolling	30	IVe	2r
MdB	Mardin channery silt loam, 2 to 8 percent slopes	31	IIw	3o
MdC	Mardin channery silt loam, 8 to 15 percent slopes	31	IIIe	3o
MdD	Mardin channery silt loam, 15 to 25 percent slopes	31	IVe	3r
MdD3	Mardin channery silt loam, 8 to 25 percent slopes, severely eroded	31	VIe	3r
MhC3	Mardin-Ovid complex, 3 to 15 percent slopes, severely eroded	32	IVe	------
	Mardin part	------	------	3o
	Ovid part	------	------	3w
MnB	Mardin and Volusia channery silt loams, silty substratum, 2 to 6 percent slopes	32	IIw	------
	Mardin part	------	------	3o
	Volusia part	------	------	3w
MnC	Mardin and Volusia channery silt loams, silty substratum, 6 to 12 percent slopes	32	IIIe	------
	Mardin part	------	------	3o
	Volusia part	------	------	3w
Mp	Middlebury silt loam	33	IIw	2o
MrB	Morris channery silt loam, 2 to 8 percent slopes	34	IIIw	3w
MrC	Morris channery silt loam, 8 to 15 percent slopes	34	IIIe	3w
MSB	Morris extremely stony soils, gently sloping	34	VIIs	3x
NgB	Niagara silt loam, 2 to 6 percent slopes	35	IIIw	3w
OC	Ochrepts and Orthents	35	VIIIs	------
OgB	Oquaga channery silt loam, 3 to 12 percent slopes	36	IIe	3o
OgC	Oquaga channery silt loam, 12 to 20 percent slopes	36	IVe	3r
OgD	Oquaga channery silt loam, 20 to 30 percent slopes	36	VIe	3r
OvB	Ovid silt loam, 2 to 6 percent slopes	37	IIIw	3w
OvC	Ovid silt loam, 6 to 12 percent slopes	37	IIIe	3w
Pa	Palms muck	37	IVw	4w
Rh	Red Hook silt loam	38	IIIw	3w
Sc	Scio silt loam	39	IIw	2o
Tg	Tioga silt loam	39	IIw	2o
TuB	Tuller channery silt loam, 0 to 6 percent slopes	40	IVw	5w
TuC	Tuller channery silt loam, 6 to 12 percent slopes	40	IVw	5w
Un	Unadilla silt loam	41	I	3o
VoB	Volusia channery silt loam, 3 to 8 percent slopes	41	IIIw	3w
VoC	Volusia channery silt loam, 8 to 15 percent slopes	41	IIIe	3w
VoD	Volusia channery silt loam, 15 to 25 percent slopes	42	IVe	3r
Wa	Wallington silt loam	42	IIIw	3w
We	Warners silt loam	43	IIIw	5w
Wn	Wayland silt loam	43	IIIw	4w
WoB	Wellsboro channery silt loam, 2 to 8 percent slopes	44	IIw	2o
WoC	Wellsboro channery silt loam, 8 to 15 percent slopes	44	IIIe	2o
WoD	Wellsboro channery silt loam, 15 to 25 percent slopes	44	IVe	2r

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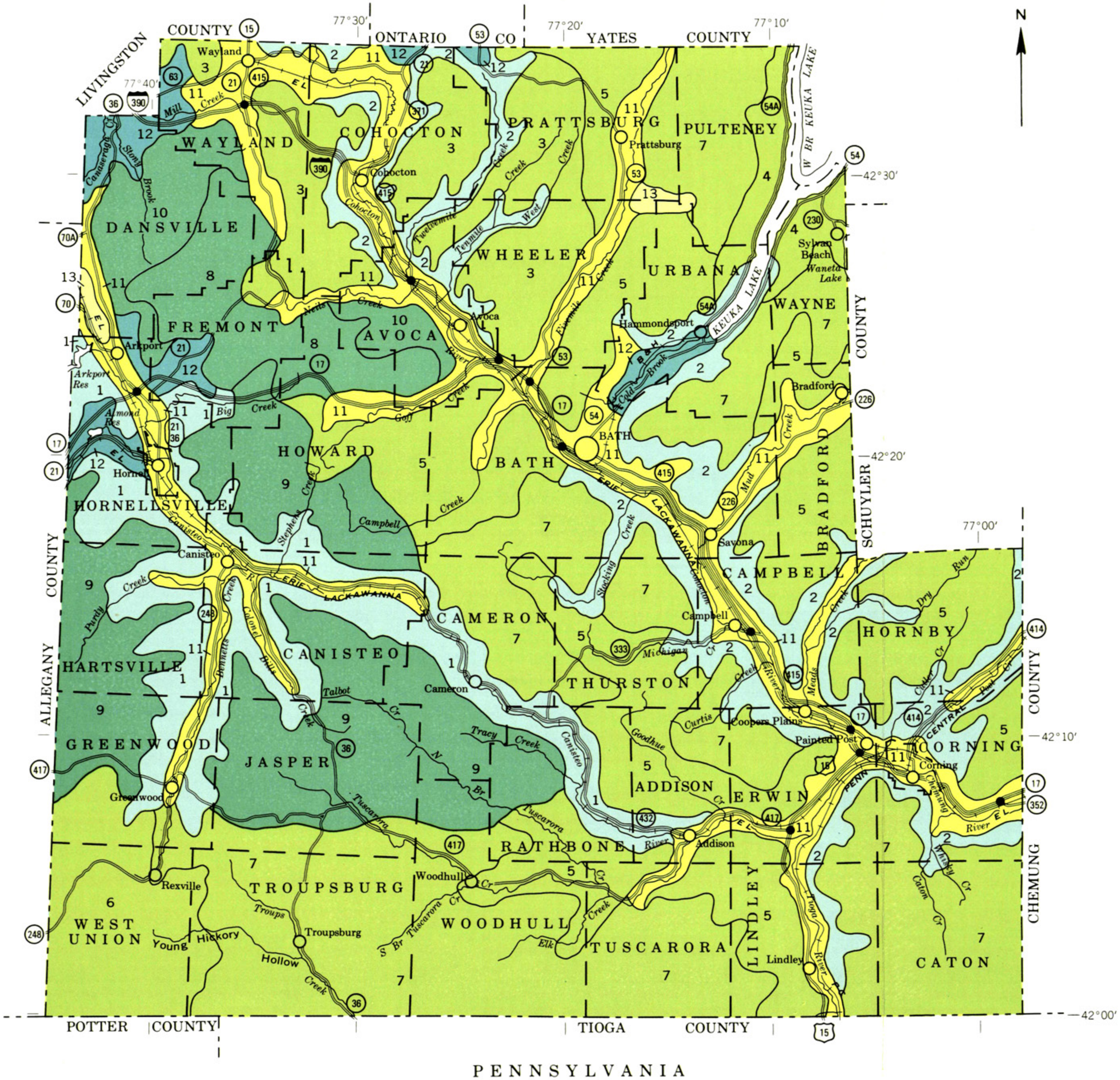
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
STEUBEN COUNTY, NEW YORK

Scale 1:316,800
1 0 1 2 3 4 5 Miles



SOIL ASSOCIATIONS

DOMINANTLY MODERATELY DEEP AND SHALLOW SOILS THAT FORMED IN THIN GLACIAL TILL DEPOSITS

1 — Hornell-Lordstown association: Moderately steep to very steep, somewhat poorly drained, deep soils overlying soft shale bedrock and well drained, moderately deep soils overlying hard sandstone bedrock; on uplands

2 — Lordstown-Arnot association: Steep and very steep, dominantly well drained, moderately deep and shallow soils overlying hard sandstone bedrock; on uplands

DOMINANTLY DEEP SOILS THAT HAVE A FRAGIPAN AND THAT FORMED IN GLACIAL TILL

3 — Bath-Lordstown association: Gently sloping and sloping, well drained, deep soils that have a fragipan and moderately deep soils overlying hard sandstone bedrock; on uplands

4 — Mardin-Ovid-Lordstown association: Gently sloping to moderately steep, moderately well drained soils that have a fragipan; moderately well drained and somewhat poorly drained, deep soils; and sloping to steep, well drained, moderately deep soils overlying sandstone bedrock; on uplands

5 — Mardin-Volusia-Lordstown association: Gently sloping to steep, moderately well drained and somewhat poorly drained, deep soils that have a fragipan and dominantly moderately steep to very steep, well drained, moderately deep soils overlying hard sandstone bedrock; on uplands

6 — Oquaga-Morris-Wellsboro association: Gently sloping to moderately steep, well drained, moderately deep soils overlying hard sandstone bedrock and somewhat poorly drained and moderately well drained, dominantly deep soils that have a fragipan; on uplands

7 — Volusia-Mardin association: Gently sloping to moderately steep, somewhat poorly drained and moderately well drained, deep soils that have a fragipan; on uplands

DEEP SOILS, MOST OF WHICH DO NOT HAVE A FRAGIPAN, THAT FORMED IN GLACIAL TILL AND GLACIAL OUTWASH

8 — Fremont-Mardin association: Nearly level to moderately steep, somewhat poorly drained, deep soils and moderately well drained, deep soils that have a fragipan; on uplands

9 — Hornell-Fremont-Mardin association: Gently sloping to moderately steep, somewhat poorly drained, moderately deep and deep soils and moderately well drained, deep soils that have a fragipan; on uplands

10 — Madrid-Howard-Mardin association: Gently sloping to moderately steep, well drained to somewhat excessively drained, deep soils and moderately well drained soils that have a fragipan; on uplands and valley sides

DEEP SOILS THAT FORMED IN GLACIAL OUTWASH DEPOSITS AND RECENT ALLUVIUM

11 — Howard-Chenango-Middlebury association: Nearly level and gently sloping, well drained and somewhat excessively drained, deep soils that formed in outwash in valleys and nearly level, moderately well drained and somewhat poorly drained, deep soils that formed in recent alluvium on floodplains

DEEP SOILS THAT FORMED IN GLACIAL-LAKE SEDIMENT, GLACIAL OUTWASH, AND RECENT ALLUVIUM

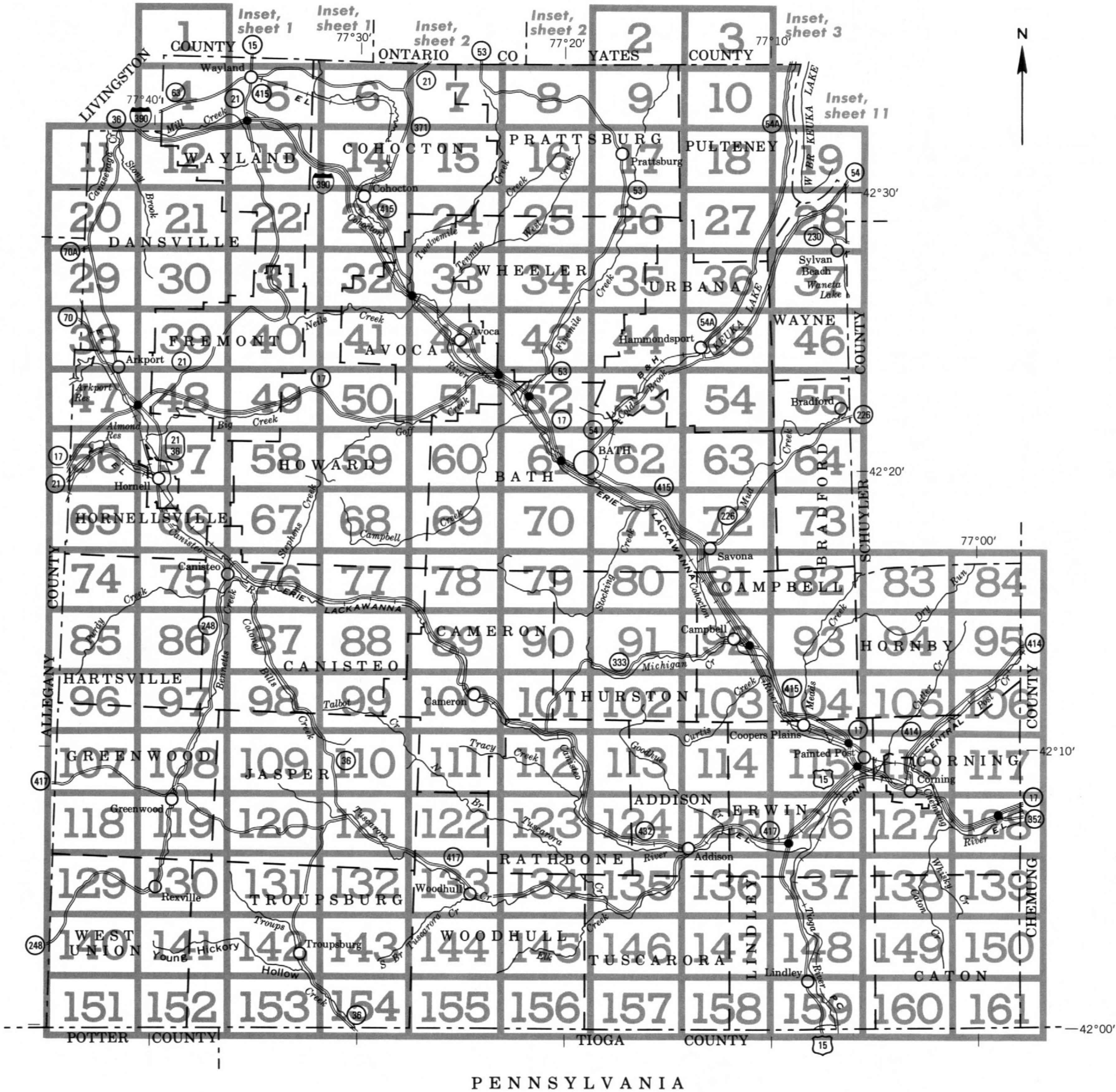
12 — Dunkirk-Howard-Wayland association: Nearly level to moderately steep, somewhat excessively drained to very poorly drained, deep soils; on lake plains, outwash kames and terraces, and floodplains

DEEP SOILS THAT FORMED IN ORGANIC DEPOSITS

13 — Carlisle-Palms association: Level to depressional, very poorly drained, deep organic soils; in swampy basins in valleys

Compiled 1977

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

STEUBEN COUNTY, NEW YORK

Scale 1:316,800

1 0 1 2 3 4 5 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the mapping unit is broadly defined; otherwise, it is a small letter. The third letter, always a capital, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for broadly defined units that have a considerable range of slope. A final number, 3, in the symbol shows that the soil is severely eroded.

SYMBOL	NAME
Aa	Alden silt loam
AlA	Alton gravelly fine sandy loam, 0 to 3 percent slopes
AlB	Alton gravelly fine sandy loam, undulating
ARC	Arnot channery silt loam, 2 to 20 percent slopes *
At	Atherton silt loam
BaB	Bath channery silt loam, 3 to 12 percent slopes
BaC	Bath channery silt loam, 12 to 20 percent slopes
BaD	Bath channery silt loam, 20 to 30 percent slopes
BBE	Bath soils, steep *
BrA	Braceville gravelly silt loam, 0 to 3 percent slopes
BrB	Braceville gravelly silt loam, 3 to 8 percent slopes
Ca	Canandaigua silt loam
CbB	Canaseraga silt loam, 2 to 6 percent slopes
CbC	Canaseraga silt loam, 6 to 12 percent slopes
Cc	Carlisle muck
Ch	Chenango channery silt loam, fan
Ck	Chippewa channery silt loam
CoC	Collamer silt loam, rolling
DuC	Dunkirk silt loam, rolling
DuD	Dunkirk silt loam, hilly
Ed	Edwards muck
FL	Fluvaquents and Ochrepts *
FrB	Fremont silt loam, 2 to 8 percent slopes
HfB	Hornell-Fremont silt loams, 1 to 6 percent slopes
HfC	Hornell-Fremont silt loams, 6 to 12 percent slopes
HgD	Hornell and Fremont silt loams, 12 to 20 percent slopes
HHE	Hornell and Fremont silt loams, steep
HkD3	Hornell and Fremont silty clay loams, 6 to 20 percent slopes, severely eroded
HoA	Howard gravelly loam, 0 to 3 percent slopes
HoB	Howard gravelly loam, undulating
HoC	Howard gravelly loam, rolling
HpD	Howard-Dunkirk complex, hilly
HrB	Howard-Madrid complex, undulating
HrC	Howard-Madrid complex, rolling
HrD	Howard-Madrid complex, 20 to 30 percent slopes
HtD	Howard and Alton gravelly soils, 20 to 30 percent slopes
HtE	Howard and Alton gravelly soils, 30 to 45 percent slopes
KaA	Kanona silty clay loam, 0 to 2 percent slopes
KaB	Kanona silty clay loam, 2 to 6 percent slopes
KaD	Kanona silty clay loam, 6 to 20 percent slopes
LaB	Lackawanna channery silt loam, 3 to 12 percent slopes
LaC	Lackawanna channery silt loam, 12 to 20 percent slopes
LC	Lackawanna-Wellsboro association, extremely stony
LoB	Lordstown channery silt loam, 3 to 12 percent slopes
LoC	Lordstown channery silt loam, 12 to 20 percent slopes
LRE	Lordstown-Arnot association, steep
LRF	Lordstown-Arnot association, very steep
MaB	Madrid fine sandy loam, undulating
MaC	Madrid fine sandy loam, rolling
MdB	Mardin channery silt loam, 2 to 8 percent slopes
MdC	Mardin channery silt loam, 8 to 15 percent slopes
MdD	Mardin channery silt loam, 15 to 25 percent slopes
MdD3	Mardin channery silt loam, 8 to 25 percent slopes, severely eroded
MhC3	Mardin-Ovid complex, 3 to 15 percent slopes, severely eroded
MnB	Mardin and Volusia channery silt loams, silty substratum, 2 to 6 percent slopes
MnC	Mardin and Volusia channery silt loams, silty substratum, 6 to 12 percent slopes
Mp	Middlebury silt loam
MrB	Morris channery silt loam, 2 to 8 percent slopes
MrC	Morris channery silt loam, 8 to 15 percent slopes
MSB	Morris extremely stony soils, gently sloping *
NgB	Niagara silt loam, 2 to 6 percent slopes
OC	Ochrepts and Orthents *
OgB	Oquaga channery silt loam, 3 to 12 percent slopes
OgC	Oquaga channery silt loam, 12 to 20 percent slopes
OgD	Oquaga channery silt loam, 20 to 30 percent slopes
OvB	Ovid silt loam, 2 to 6 percent slopes
OvC	Ovid silt loam, 6 to 12 percent slopes
Pa	Palms muck
Rh	Red Hook silt loam
Sc	Scio silt loam
Tg	Tioga silt loam
TuB	Tuller channery silt loam, 0 to 6 percent slopes
TuC	Tuller channery silt loam, 6 to 12 percent slopes
Un	Unadilla silt loam
VoB	Volusia channery silt loam, 3 to 8 percent slopes
VoC	Volusia channery silt loam, 8 to 15 percent slopes
VoD	Volusia channery silt loam, 15 to 25 percent slopes
Wa	Wallington silt loam
We	Warners silt loam
Wn	Wayland silt loam
WoB	Wellsboro channery silt loam, 2 to 8 percent slopes
WoC	Wellsboro channery silt loam, 8 to 15 percent slopes
WoD	Wellsboro channery silt loam, 15 to 25 percent slopes

* The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to be interpreted for the expected use of the soils.

STEUBEN COUNTY, NEW YORK

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

CeA FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

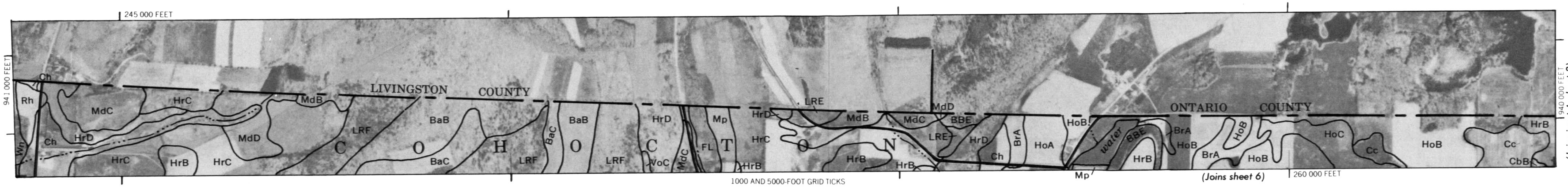
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cut and fill land — C.F.

1

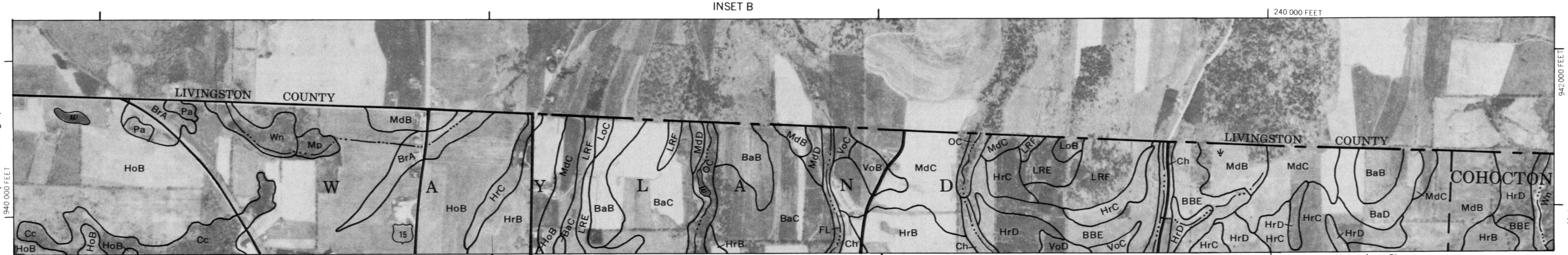
N

INSET A

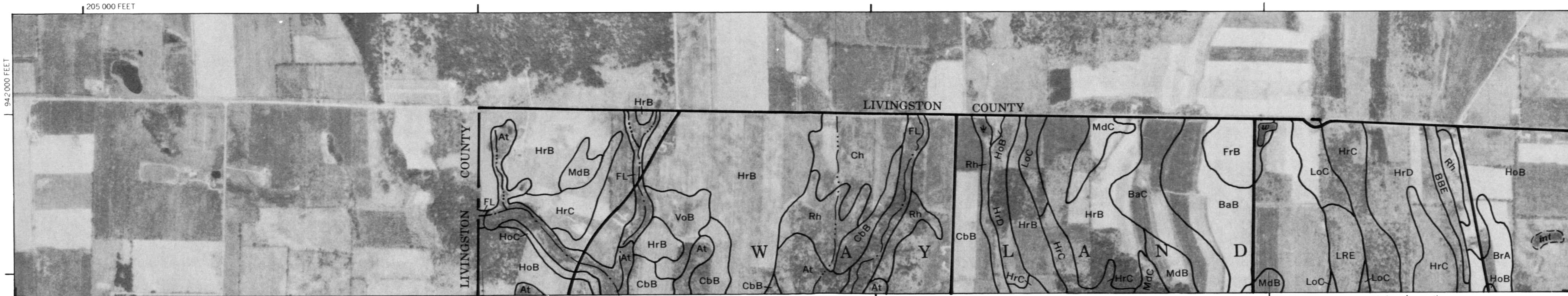


1000 AND 5000-FOOT GRID TICKS

INSET B



2000 AND 5000-FOOT GRID TICKS



2000 AND 5000-FOOT GRID TICKS

1 Mile

5 000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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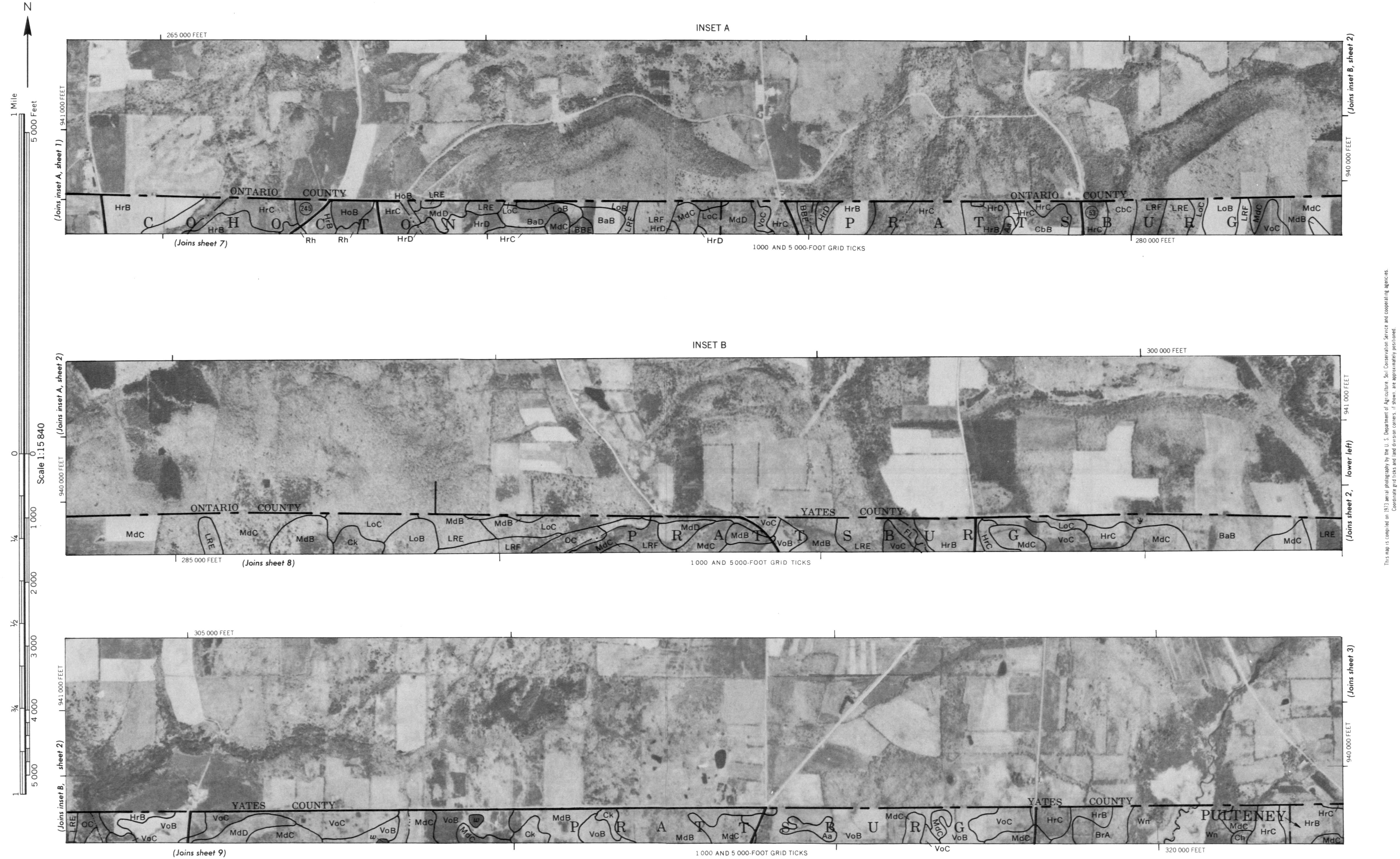
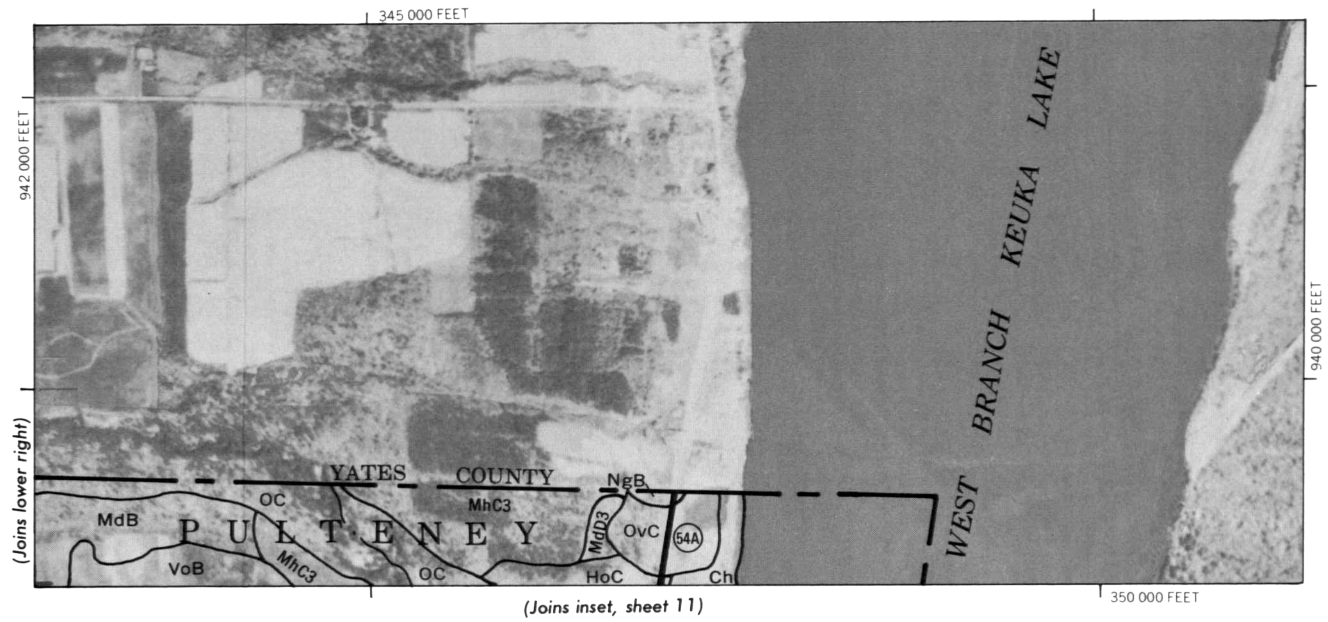
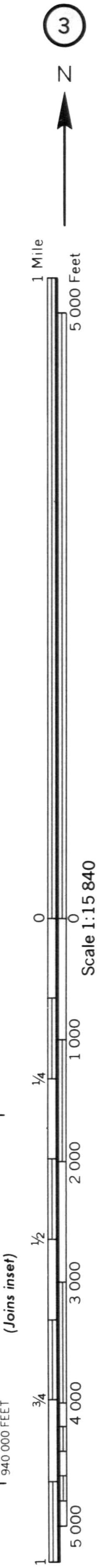
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 2







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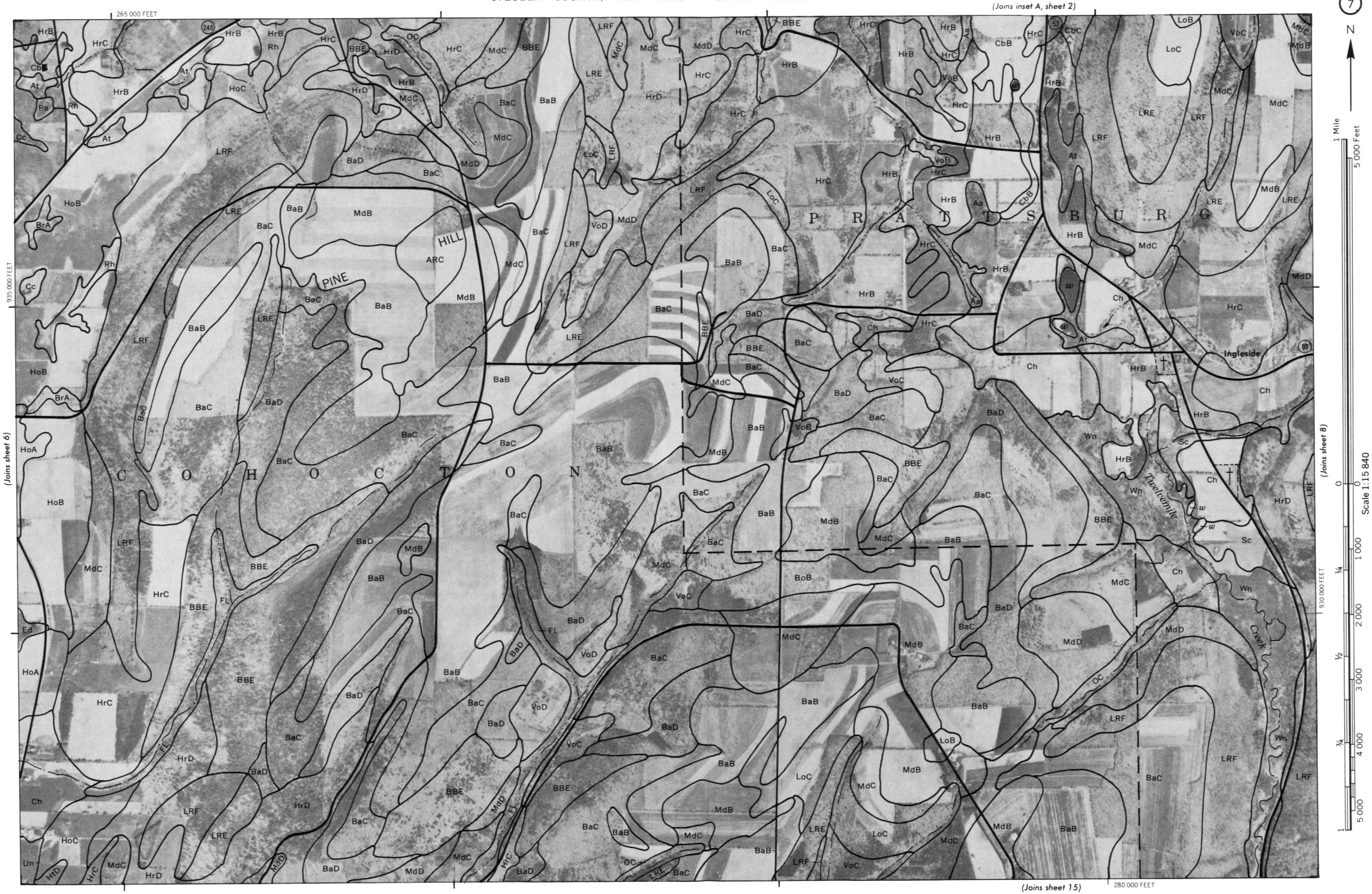
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 7



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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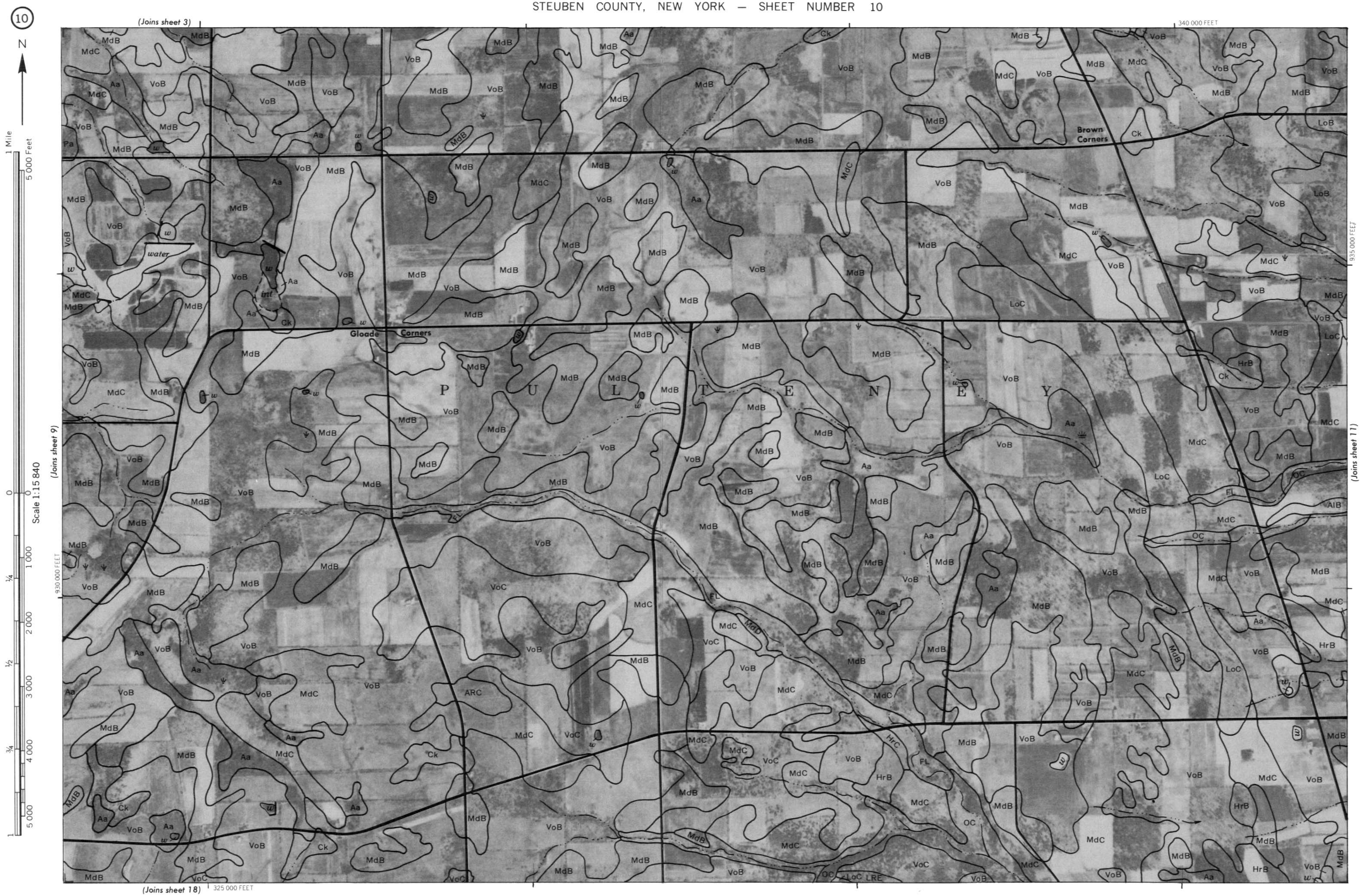

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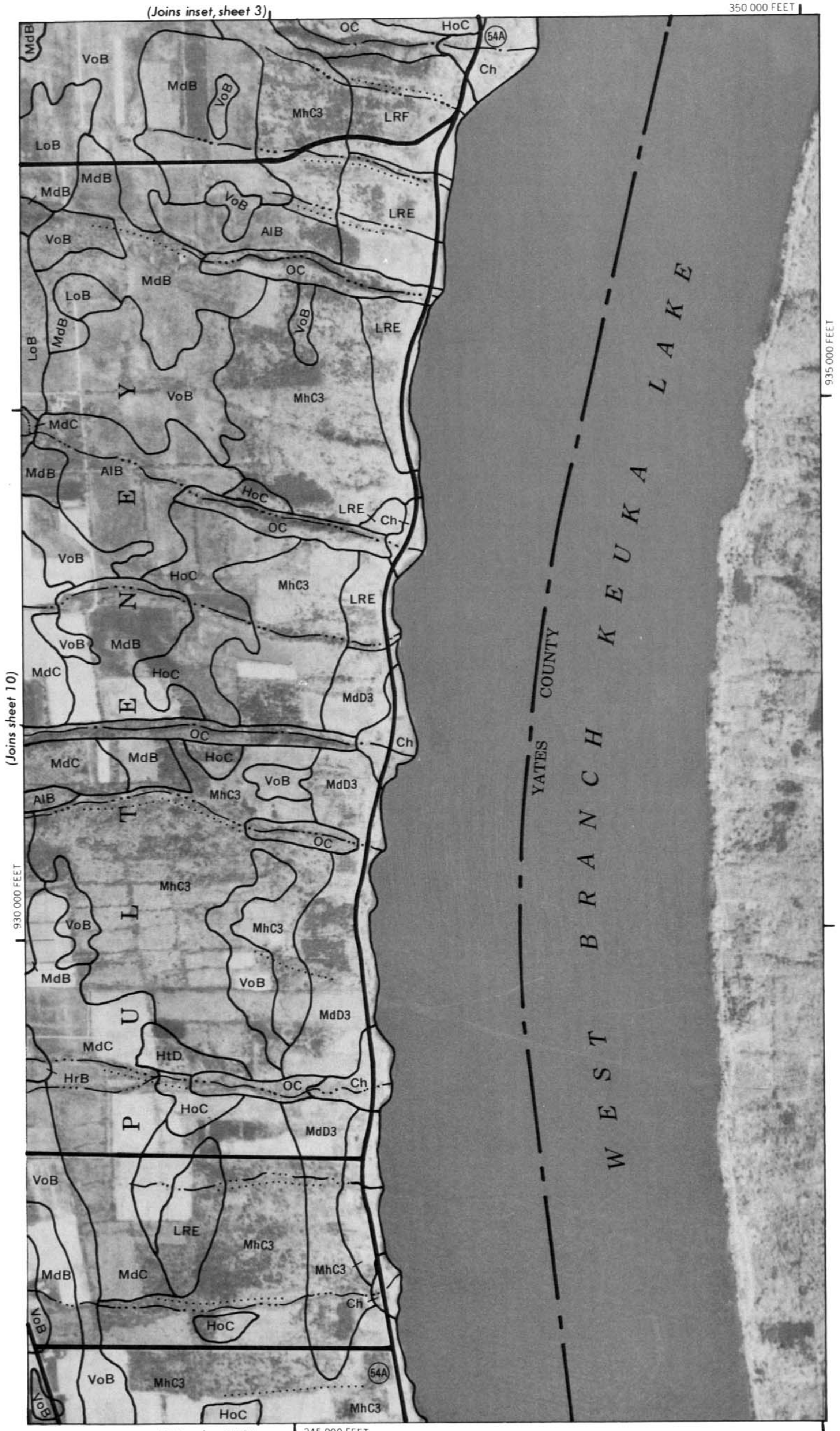
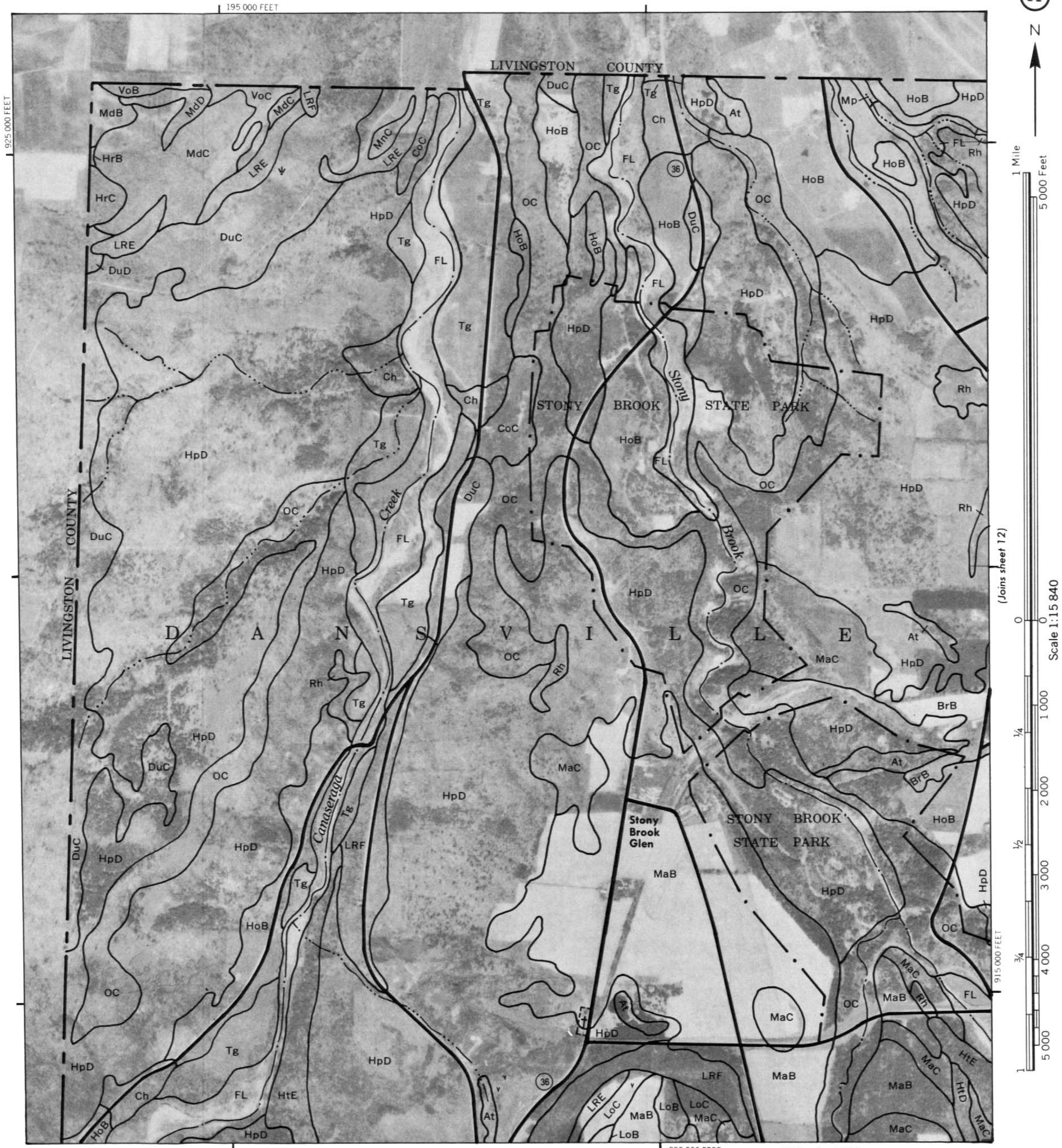
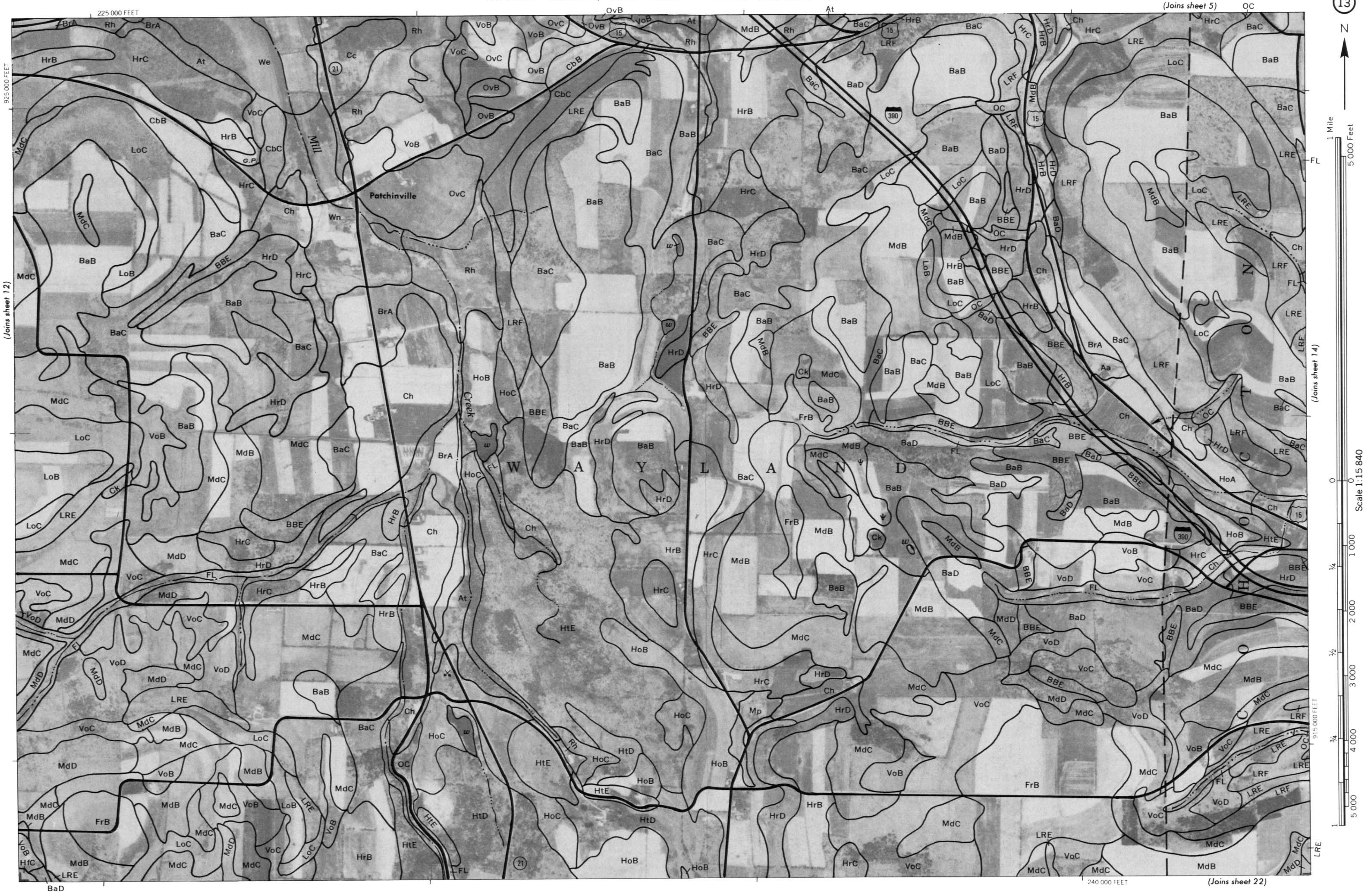




This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

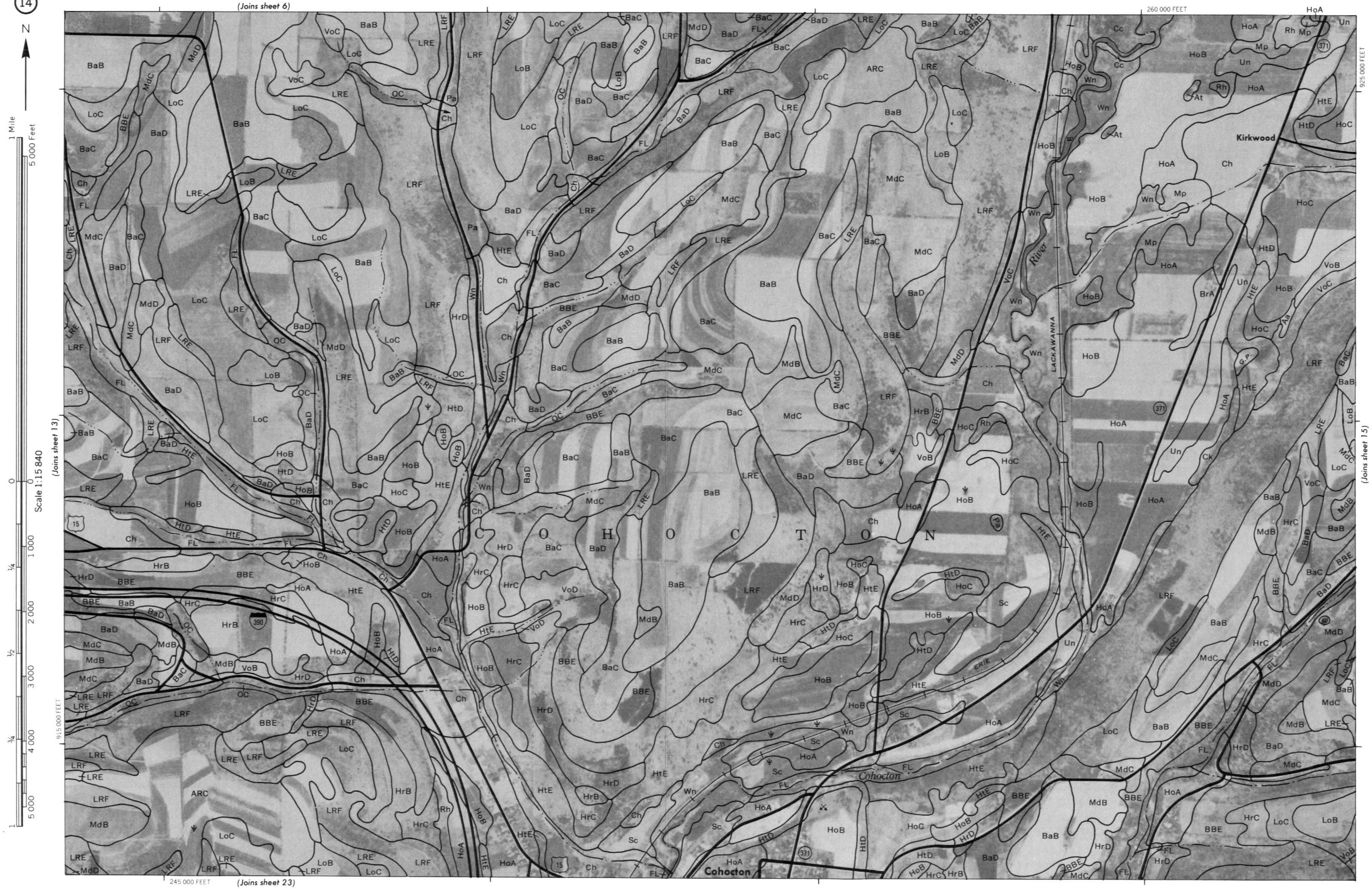
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 12

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 14



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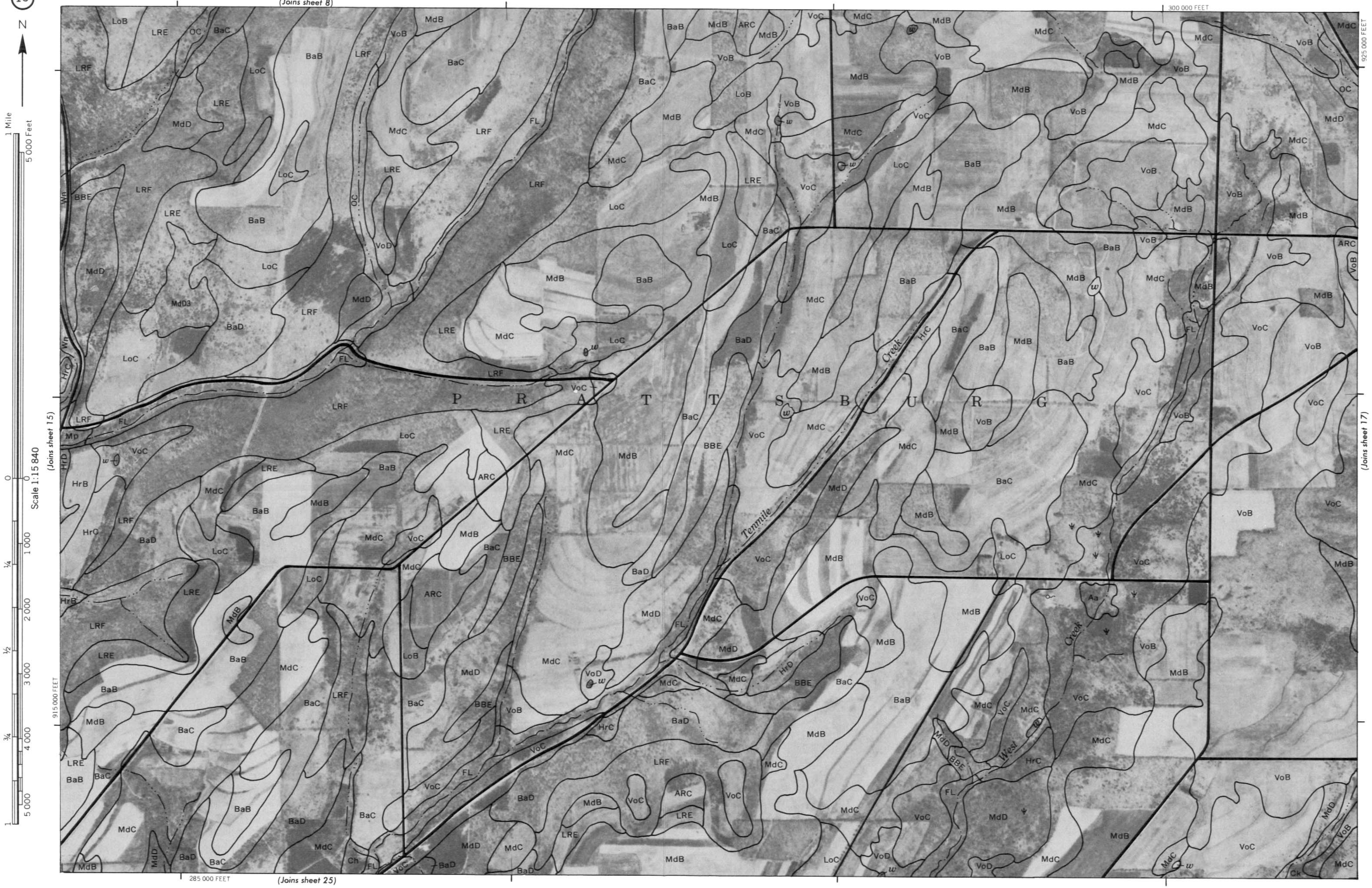

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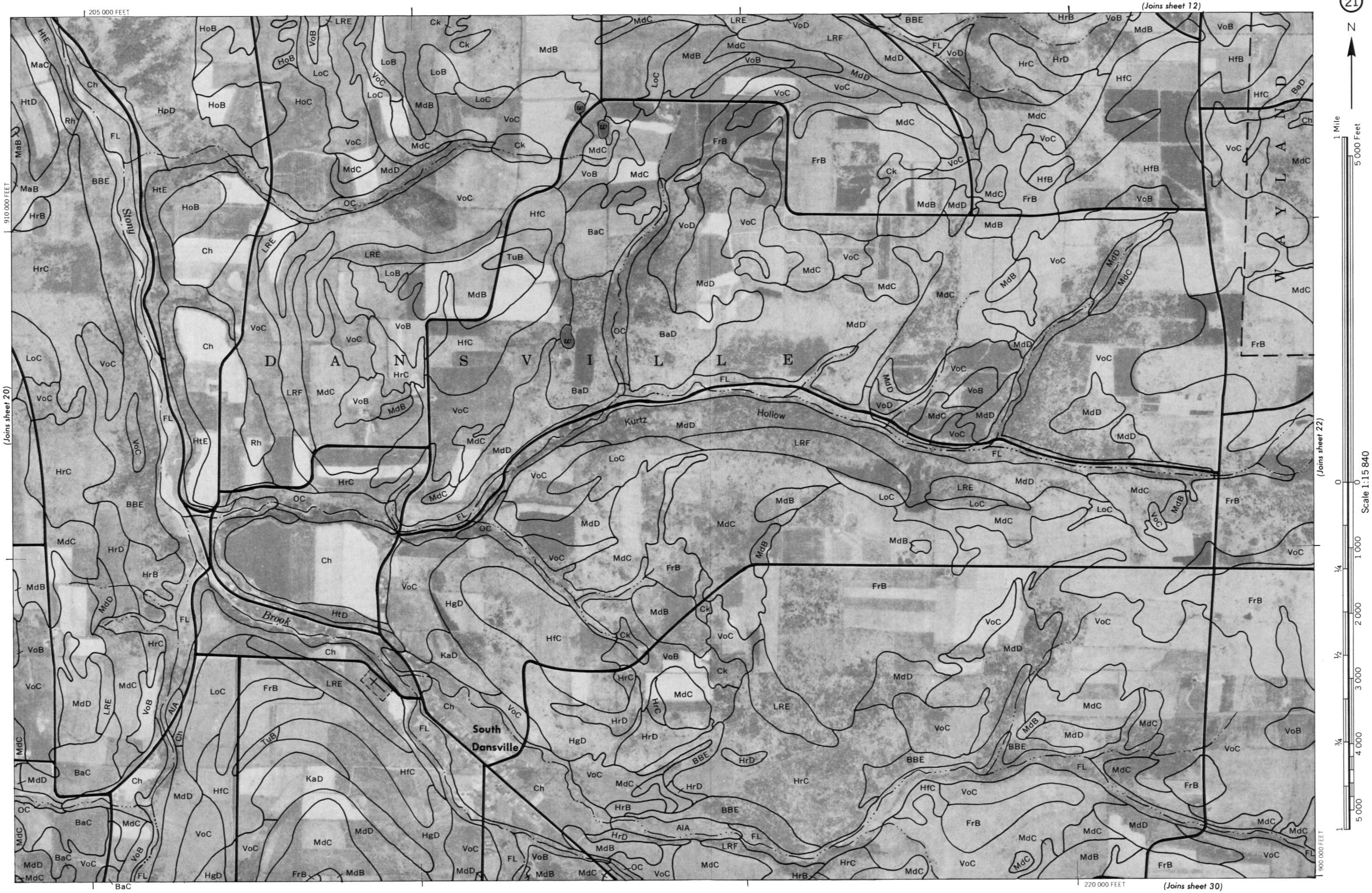

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 13)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 31)
N
1 Mile
5 000 Feet
Scale 1:15 840
240 000 FEET
910 000 FEET
225 000 FEET
900 000 FEET
W A Y L A N D
D A N S V I L L E
C O H O C T O N
Loon Lake
Hill
Bronson
water
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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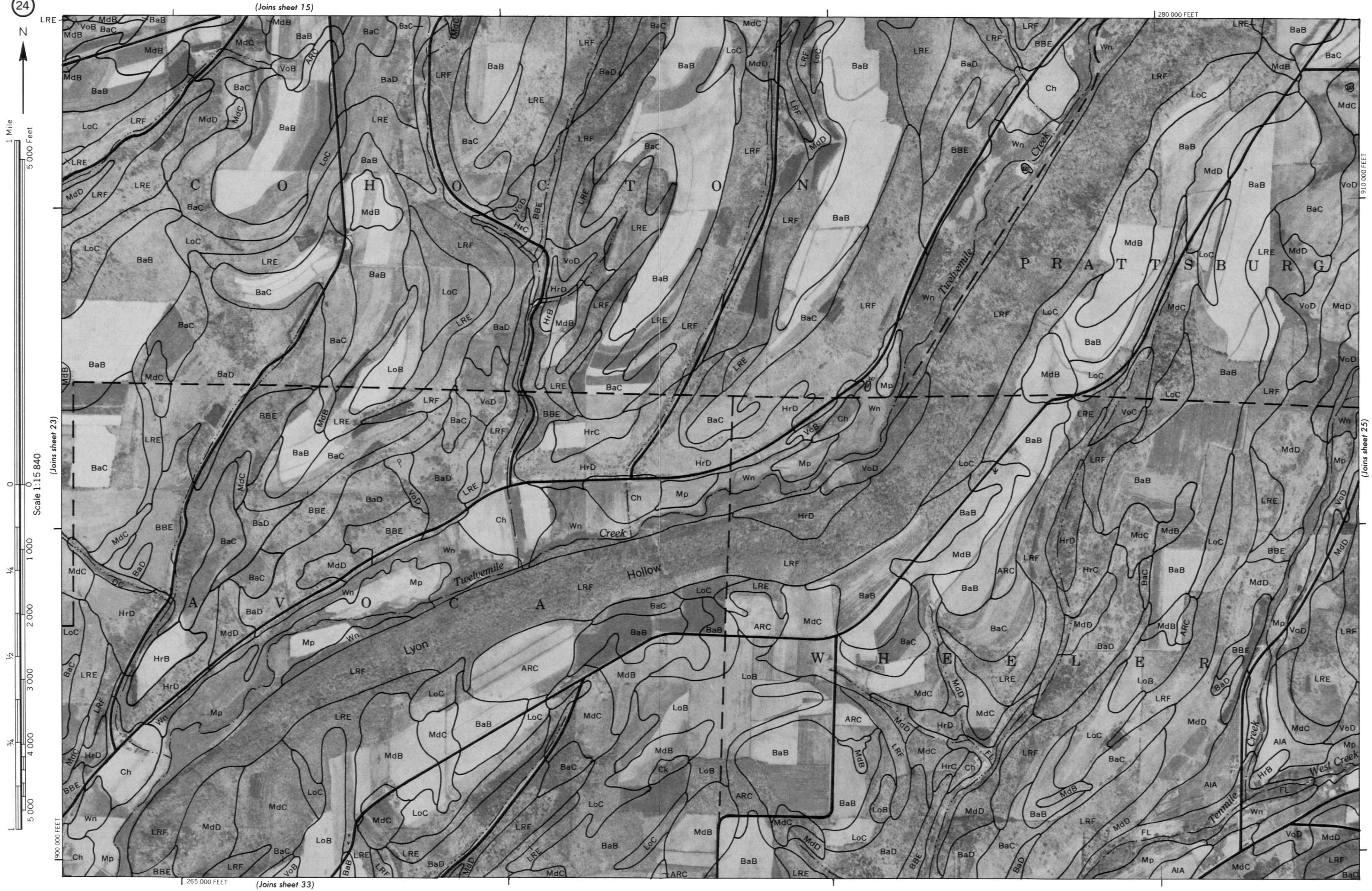
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 24



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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STEUBEN COUNTY, NEW YORK — SHEET NUMBER 26

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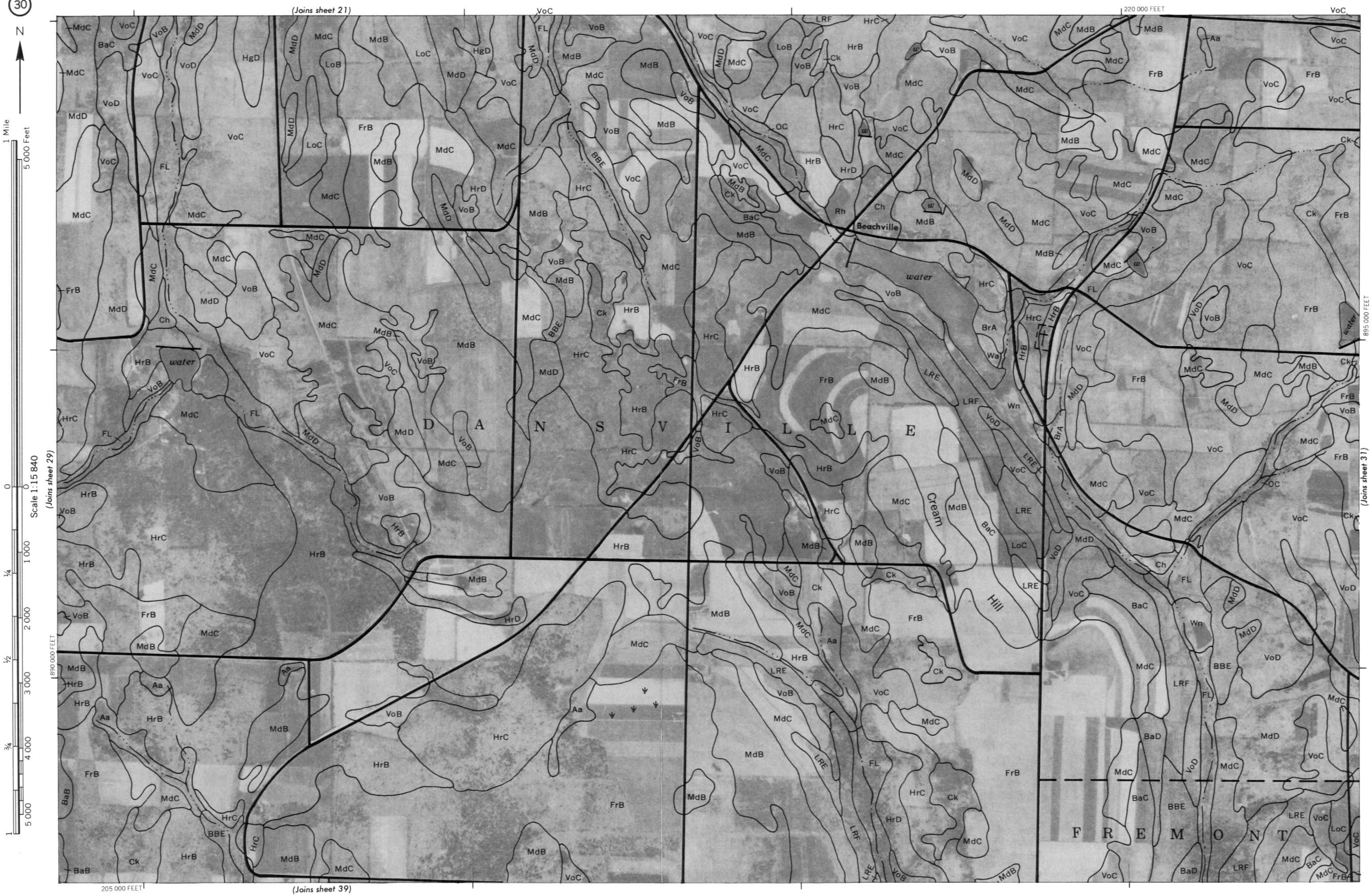
29
N
(Joins sheet 20)
(Joins sheet 30)
(Joins sheet 38)
185 000 FEET
900 000 FEET
890 000 FEET
200 000 FEET
ALLEGANY COUNTY
D A N S V I L L E
OAK HILL
Burns
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
Scale 1:15 840
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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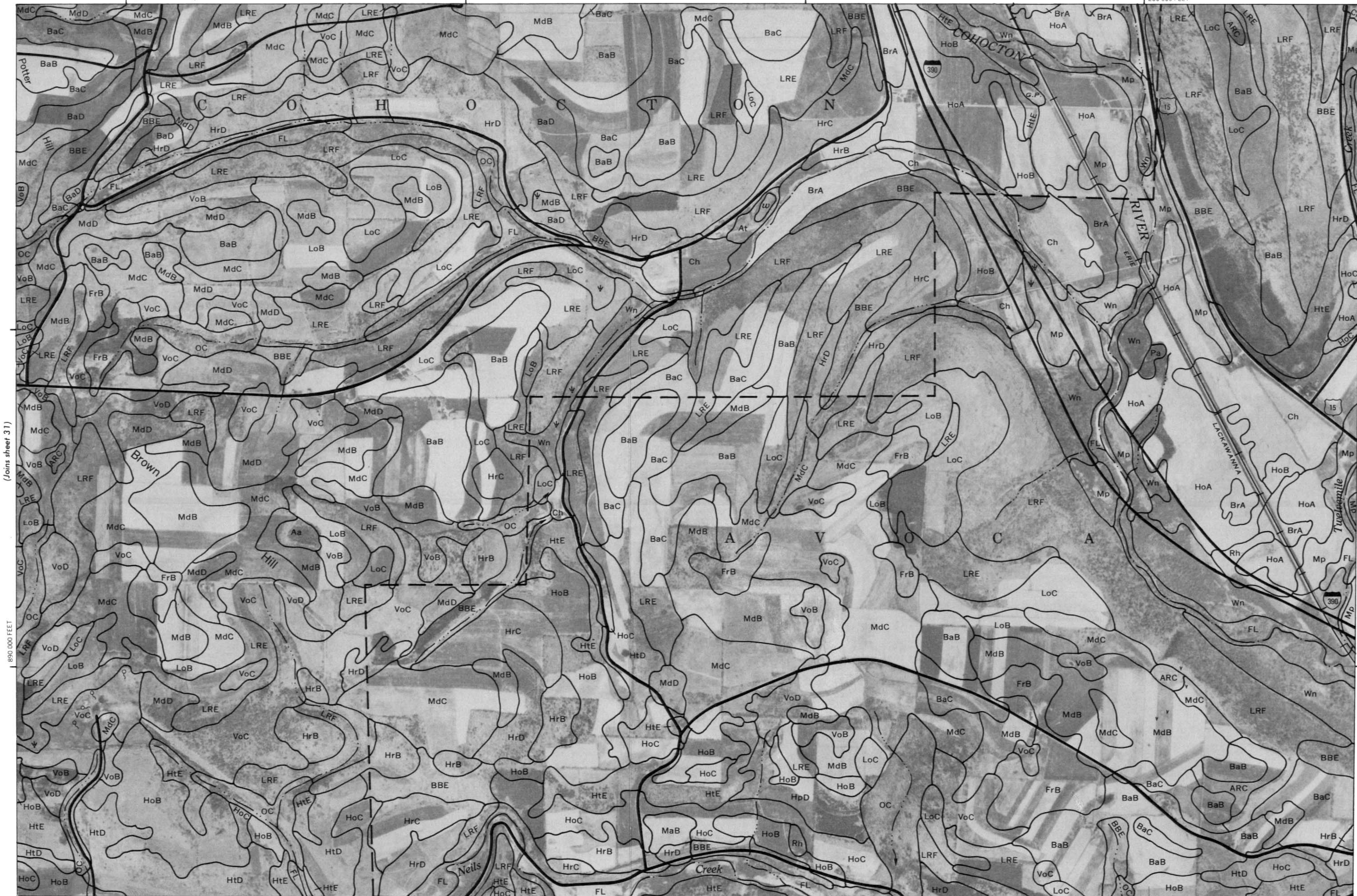

N

Scale 1:15 840

1 Mile

5 000 Feet

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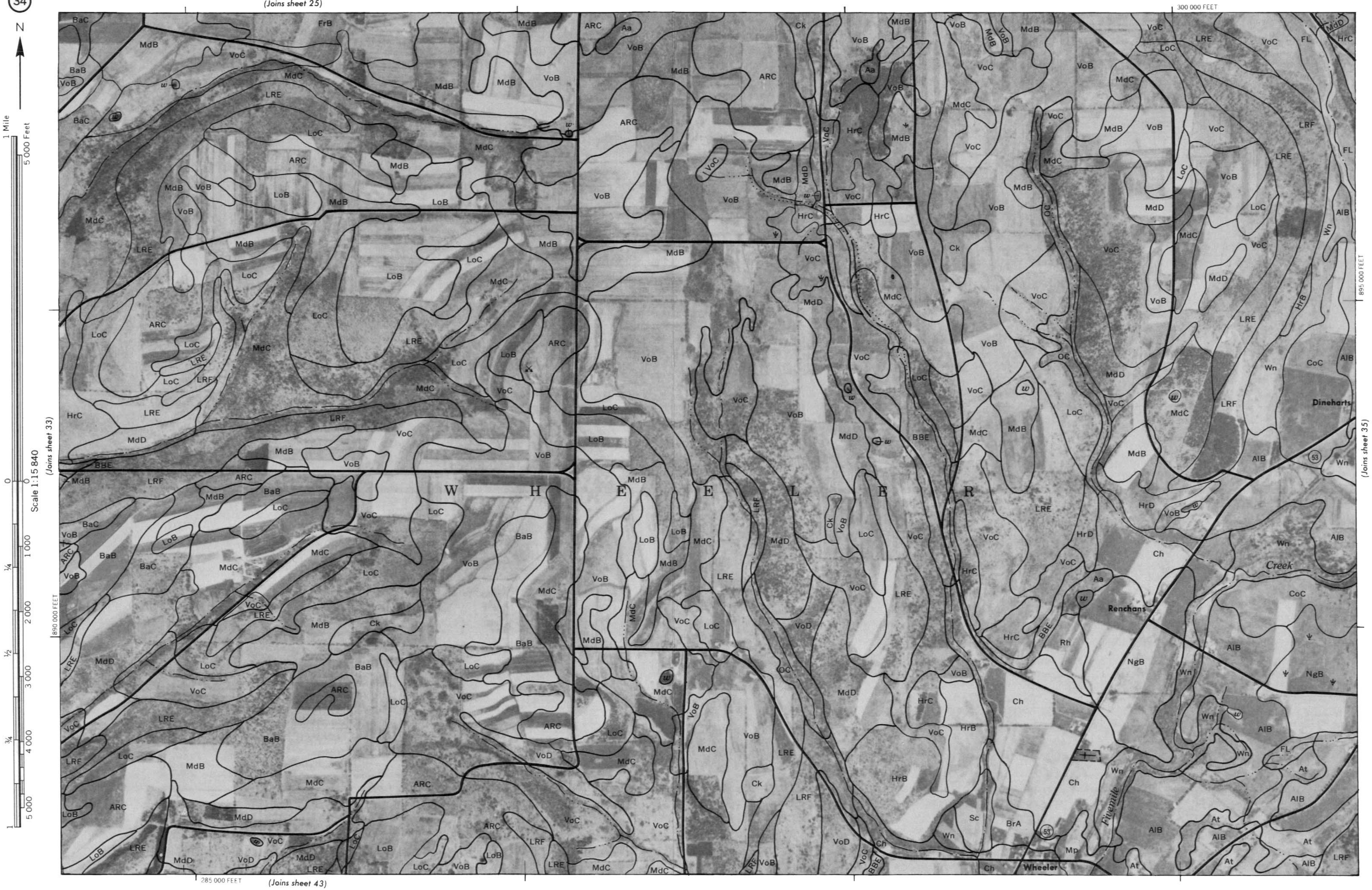

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37

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STEUBEN COUNTY, NEW YORK — SHEET NUMBER 38

(Joins sheet 29)

(Joins sheet 39)

(Joins sheet 47)

N

1 Mile — 5 000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

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40
N
(Joins sheet 31)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 49)
COHOCTON
240 000 FEET
885 000 FEET
875 000 FEET
225 000 FEET
Haskinville
Jobs Corner
Nails Creek
F R E M O N T
W
H O W A R D
water
1 Mile
5 000 Feet
Scale 1:15 840
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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42
N
(Joins sheet 33)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 51)
280 000 FEET
885 000 FEET
875 000 FEET
265 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
W H E E L E R
A V O C A
Avoca
COHOCTON RIVER
Tenmile Creek
Cotton Creek
Loucks Pond
ERIE
LACKAWANNA
C.F.
15
390

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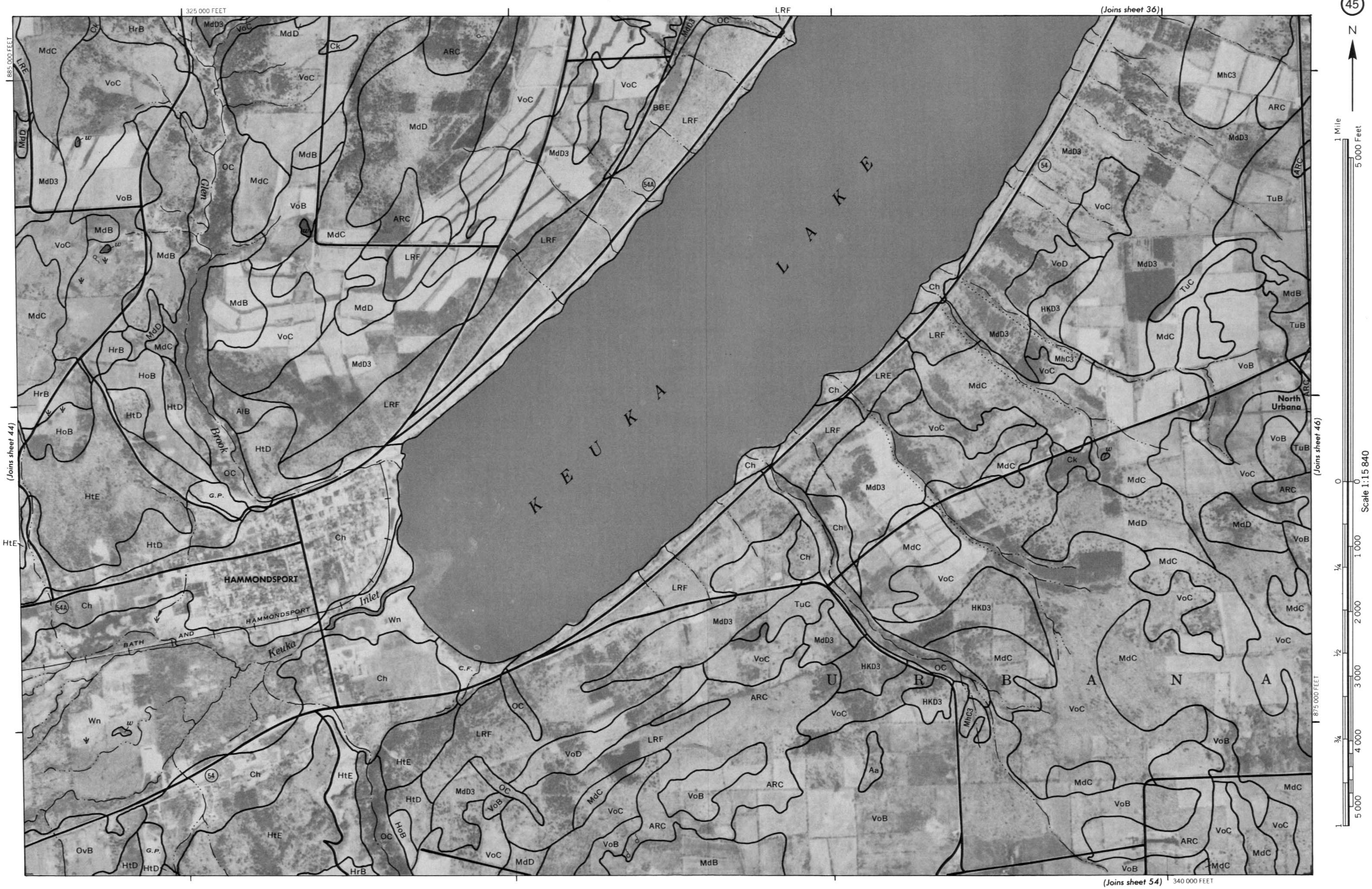
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 44

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 45



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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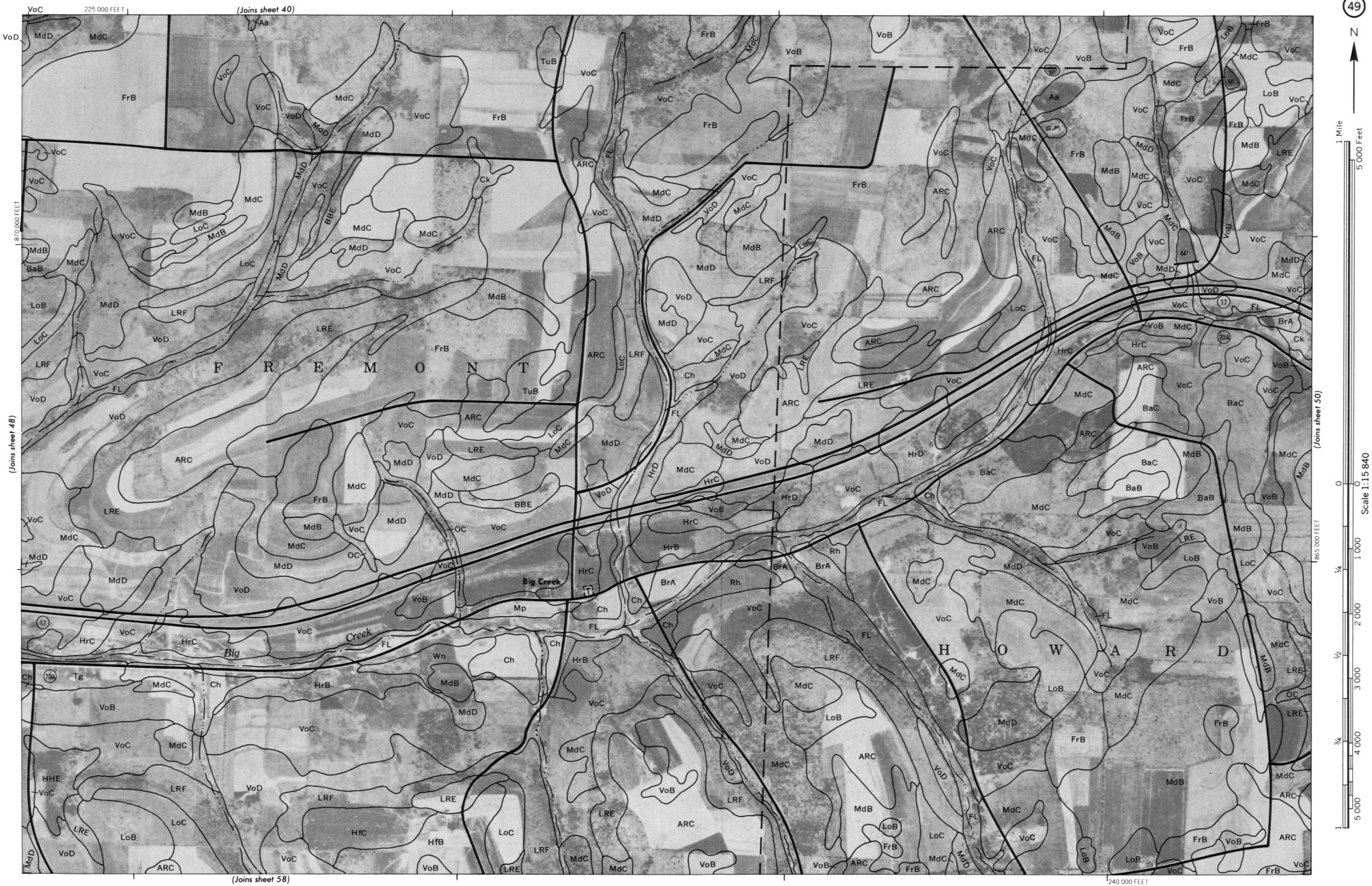
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 39)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 57)
N
Scale 1:15 840
1 Mile
5 000 Feet
220 000 FEET
870 000 FEET
865 000 FEET
205 000 FEET
F R E M O N T
H O R N E L L S V I L L E
HORNELL MAPLE CITY AIRPORT
Hornell Reservoir No. 1
Reservoir No. 3
Seeley Creek
Big Creek
ERIE LACKAWANNA
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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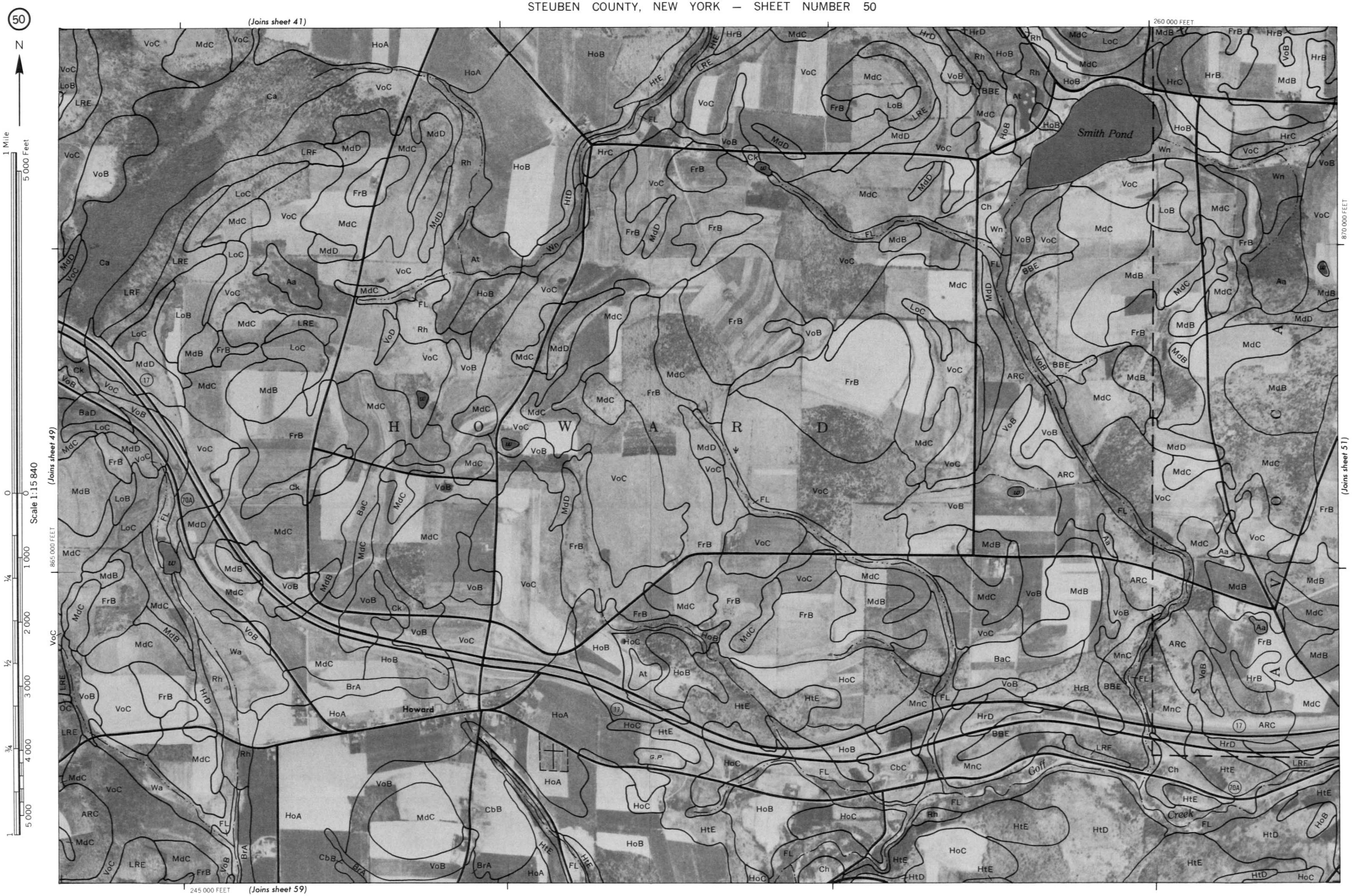

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

51


(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 60)
265 000 FEET
280 000 FEET
870 000 FEET
860 000 FEET
WHEELER
AVOCA
BATH
HOWARD
COHOCTON
RIVER
ERIE
LACKAWANNA
Loucks Pond
water
Goff Creek
Campbell Creek
N
1 Mile
5 000 Feet
Scale 1:15 840
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


(Joins sheet 43)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 61)
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
300 000 FEET
870 000 FEET
860 000 FEET
285 000 FEET
A V O C A
W H E E L E R
B A T H
Kanona
Cohocton
River
Fivemile
Creek
Goff
Creek
Campbell
Creek
Brooks
Hill
HICKORY
HILL
Harrisburg
Hollow
KERSHENER
HILL
ERIE
LACKAWANNA
15
17
53
415
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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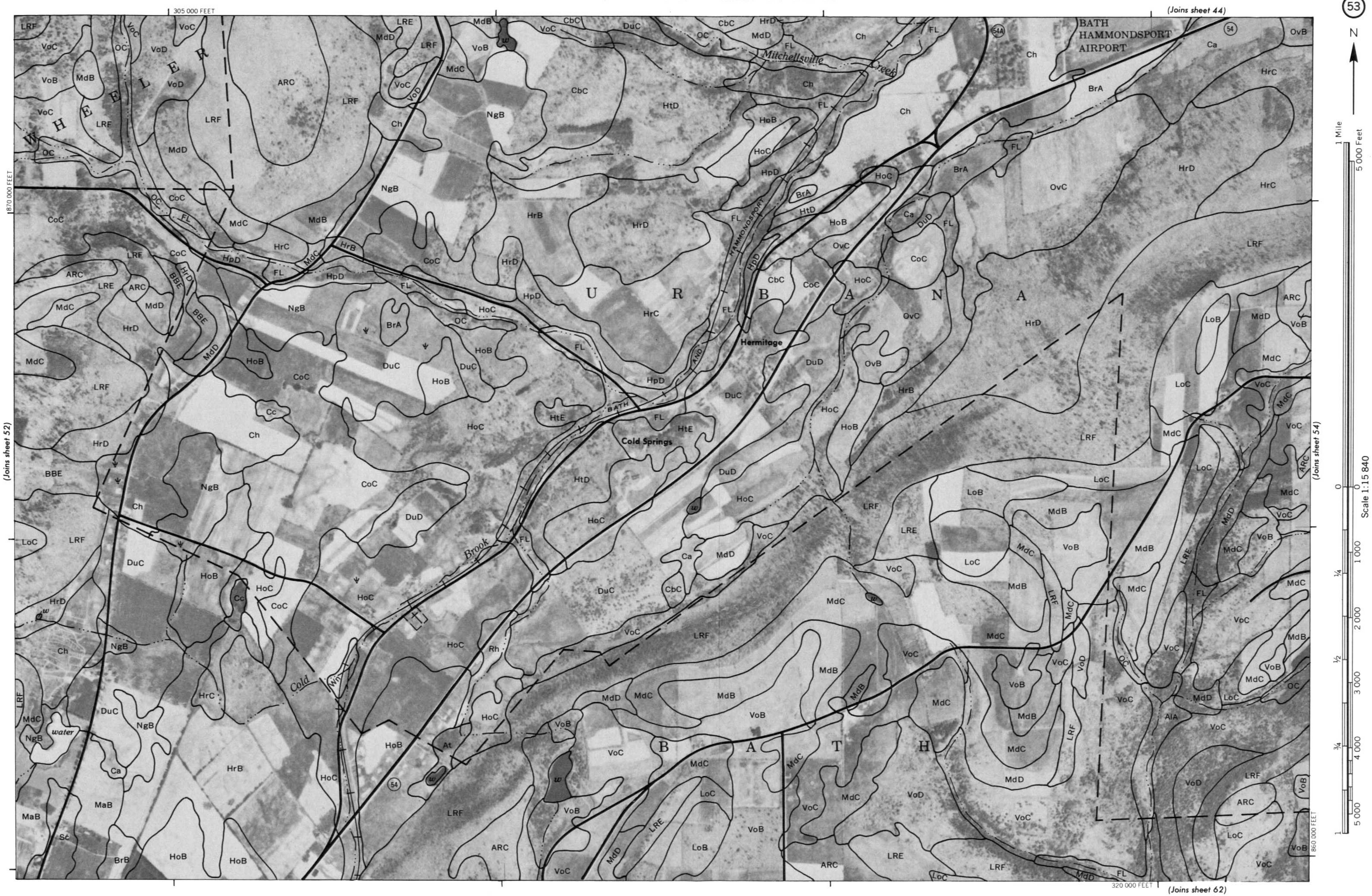

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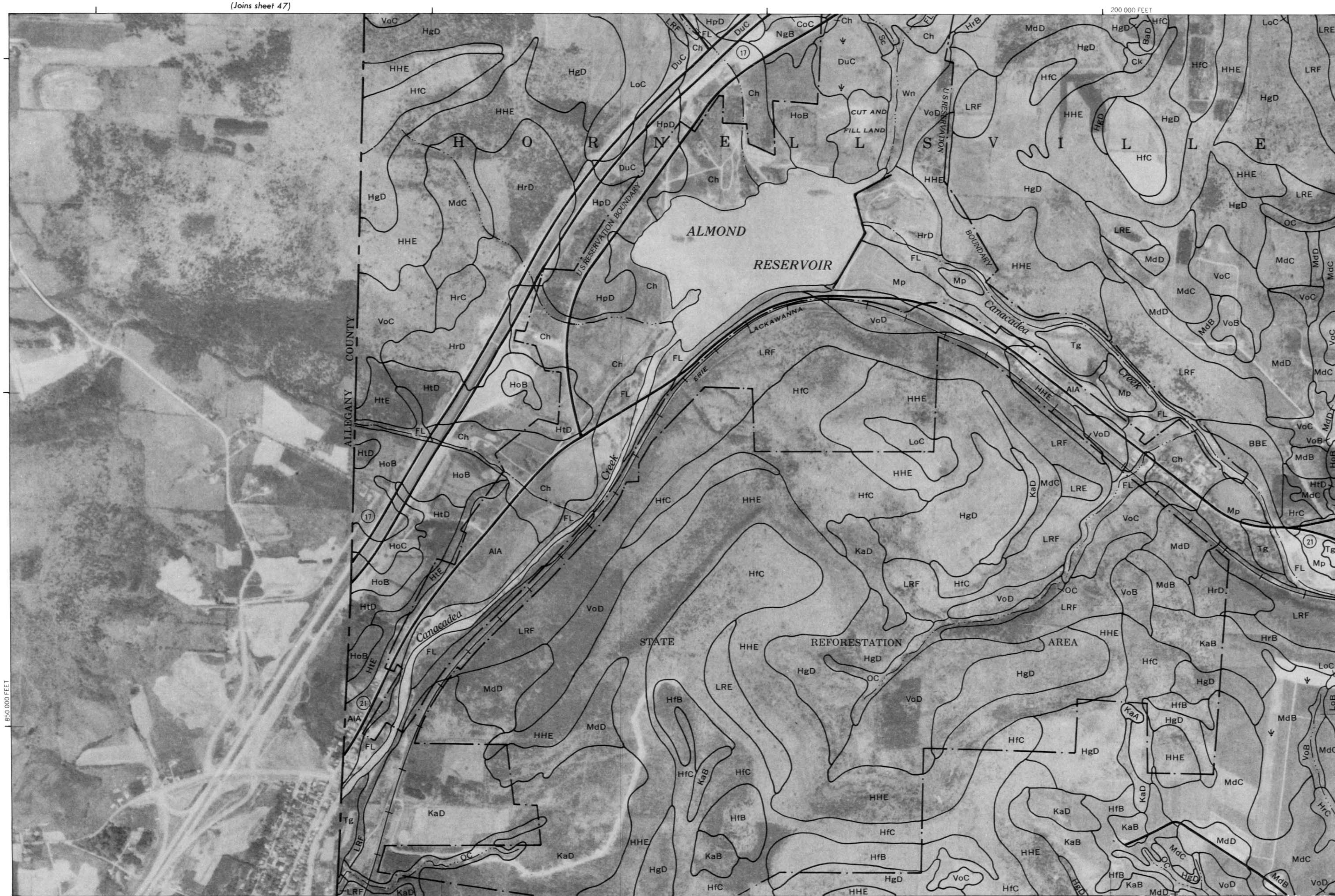
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 56

(Joins sheet 47)

N



(Joins sheet 57)

(Joins sheet 65)

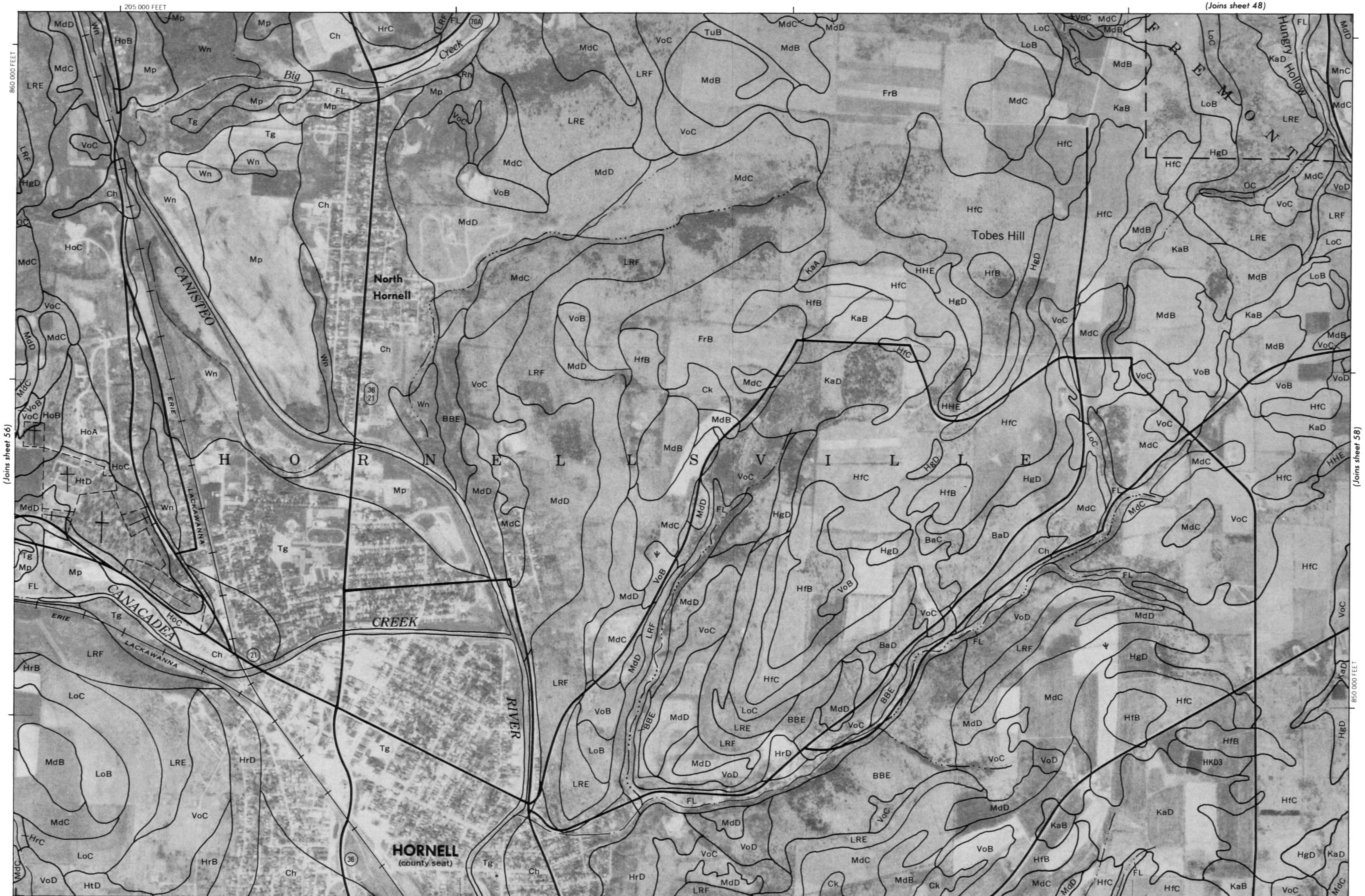
Scale 1:15 840

1 Mile — ¾ — ½ — ¼ — 0

5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0 — 5 000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

57



N

1 Mile
5 000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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61

(Joins sheet 52)

285 000 FEET

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 70)

300 000 FEET

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

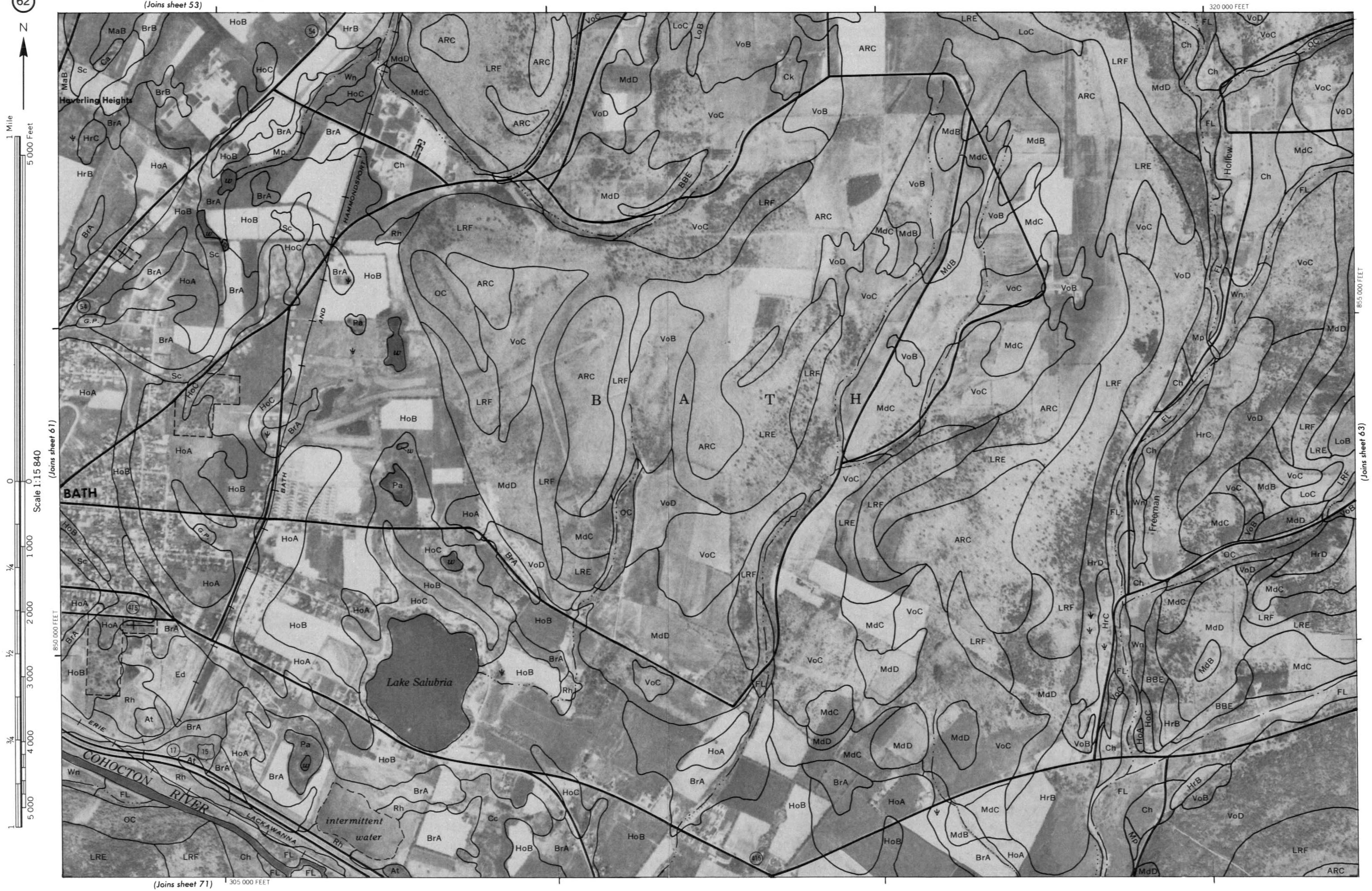
Scale 1:15 840

1 Mile

5 000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



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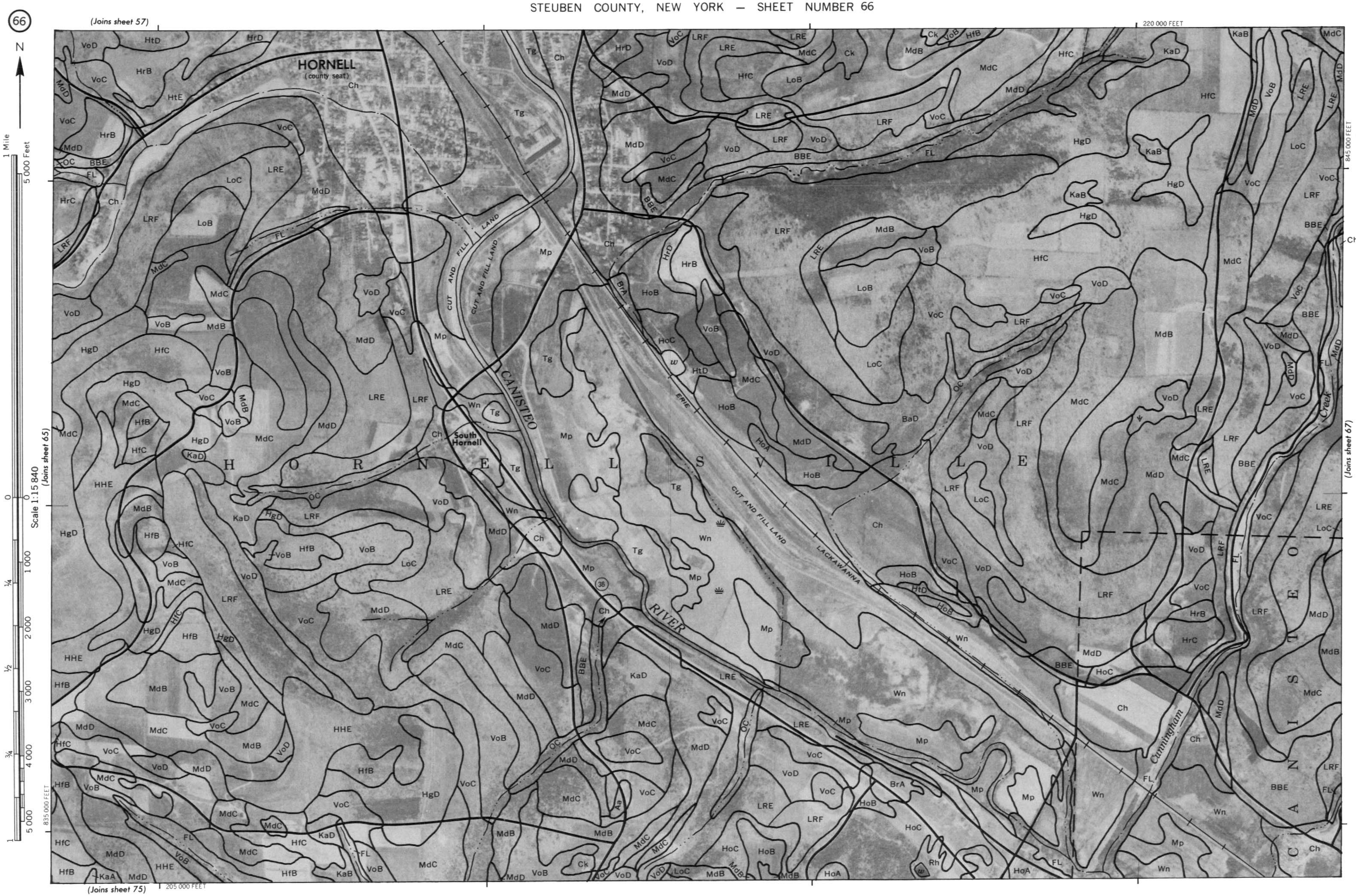

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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STEUBEN COUNTY, NEW YORK — SHEET NUMBER 74

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 67)

(Joins sheet 75)

(Joins sheet 77)

(Joins sheet 87)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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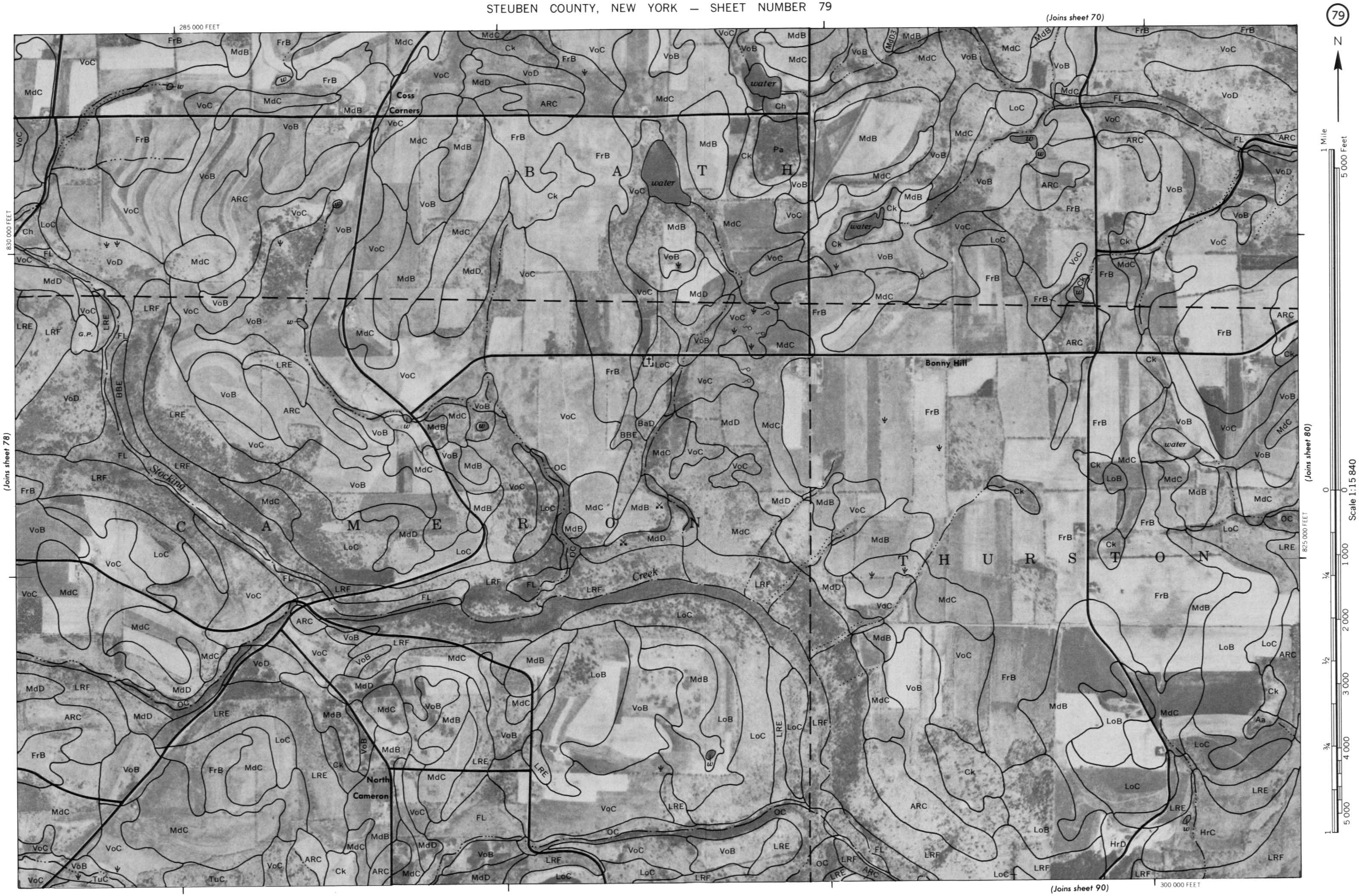
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 78

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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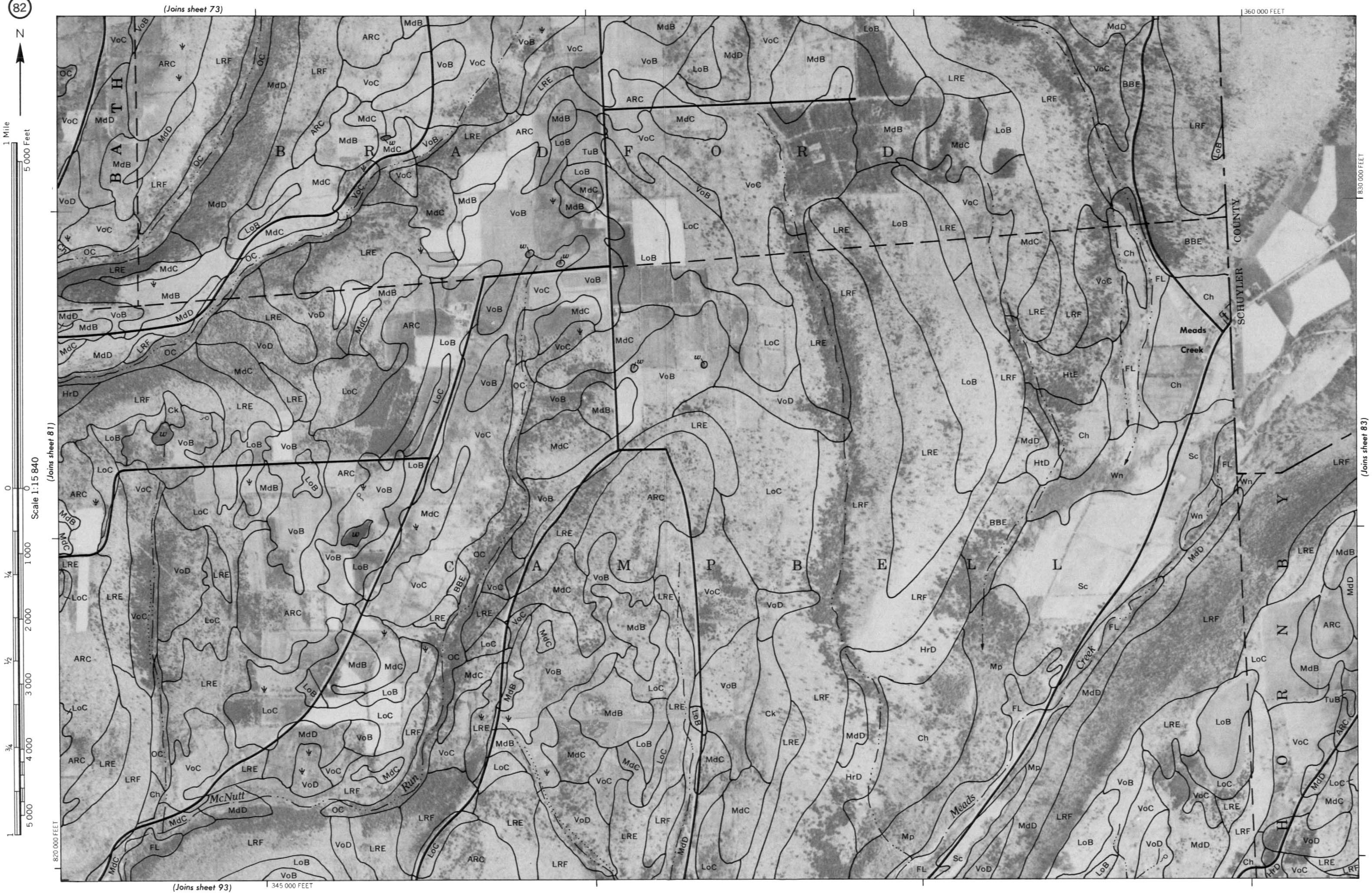
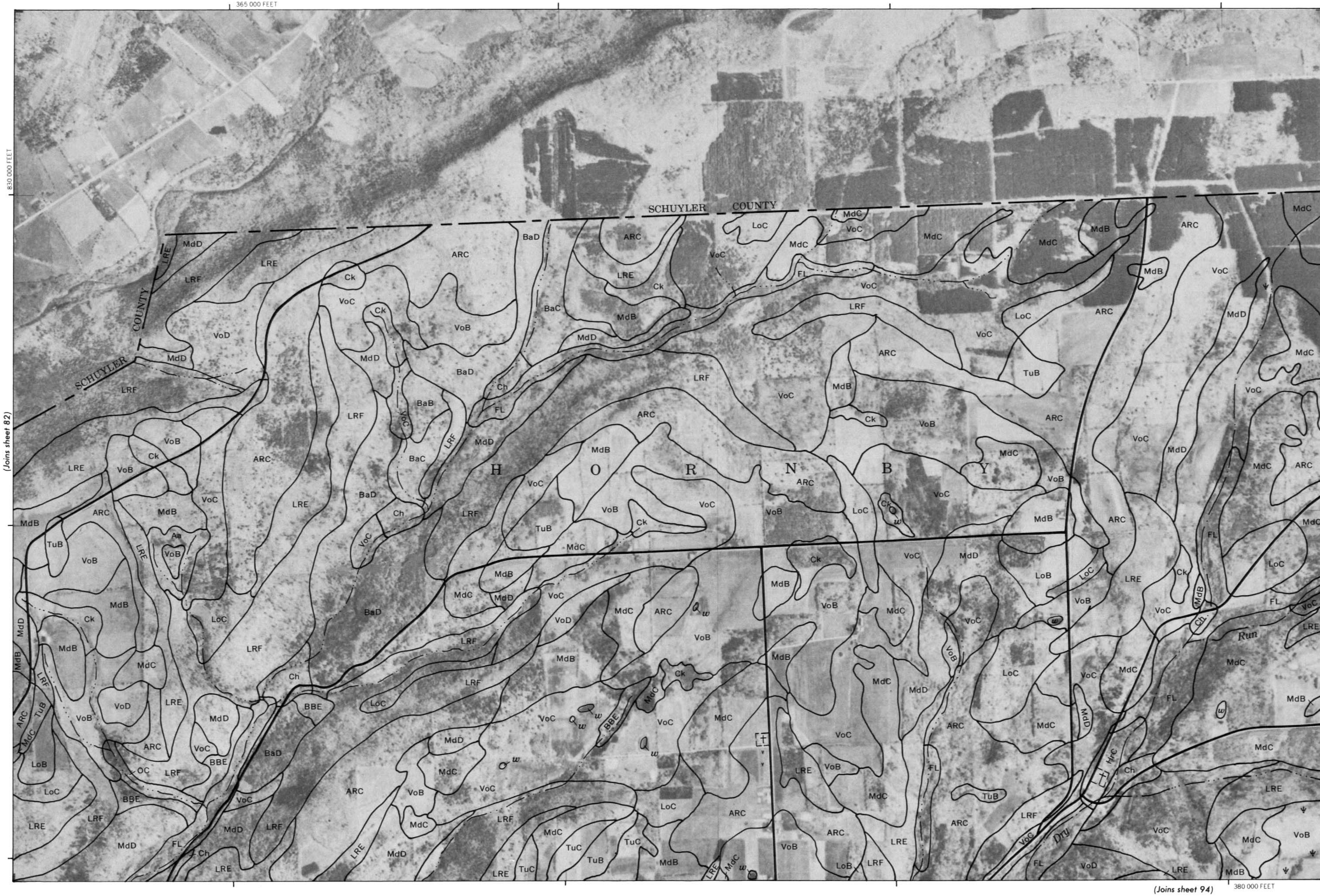
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 82



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 Mile
5 000 Feet
Scale 1:15 840
0 | 1 000 | 2 000 | 3 000 | 4 000 | 5 000
0 | ¼ | ½ | ¾ | 1

(Joins sheet 83)

(Joins sheet 95)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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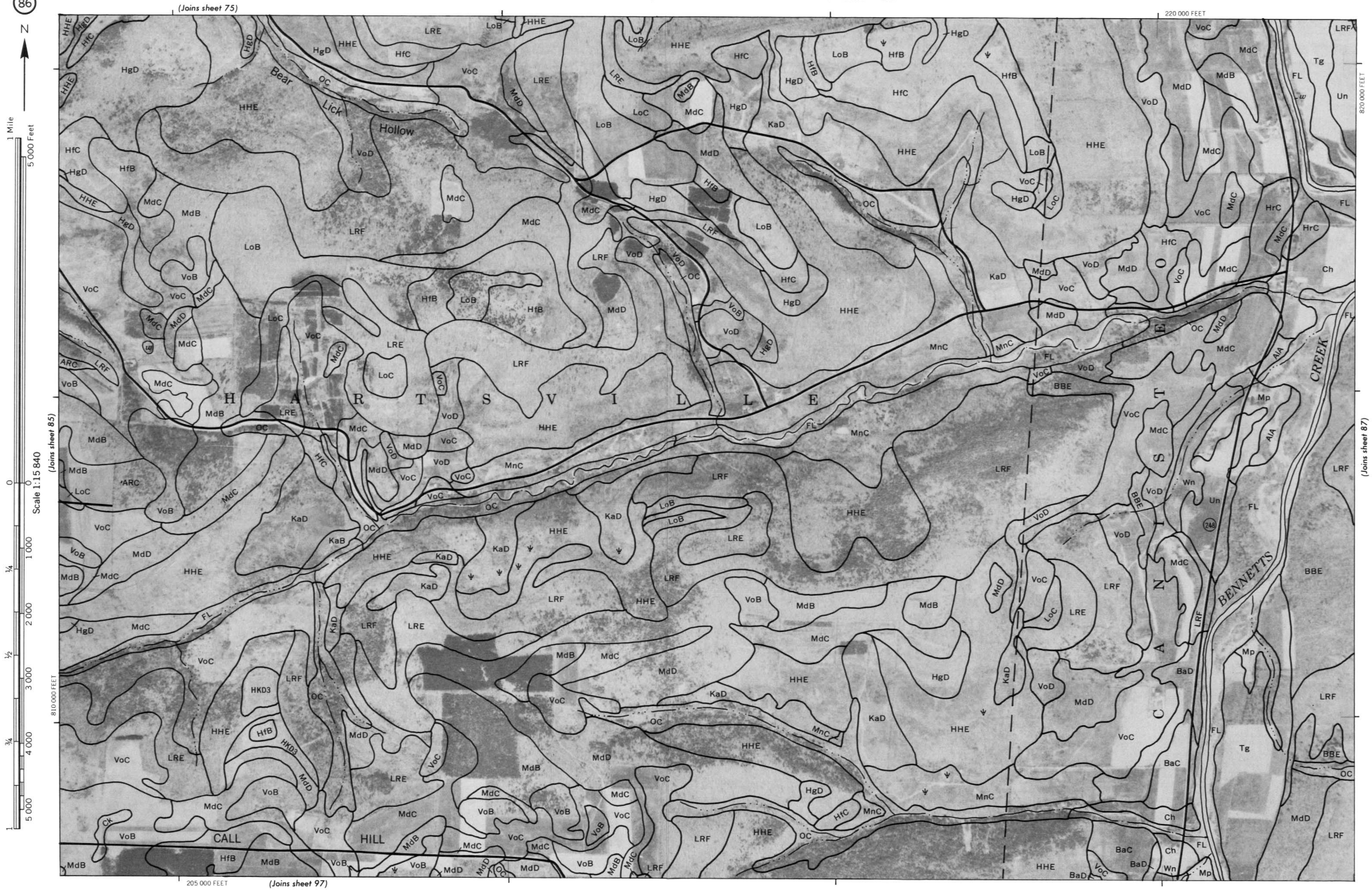

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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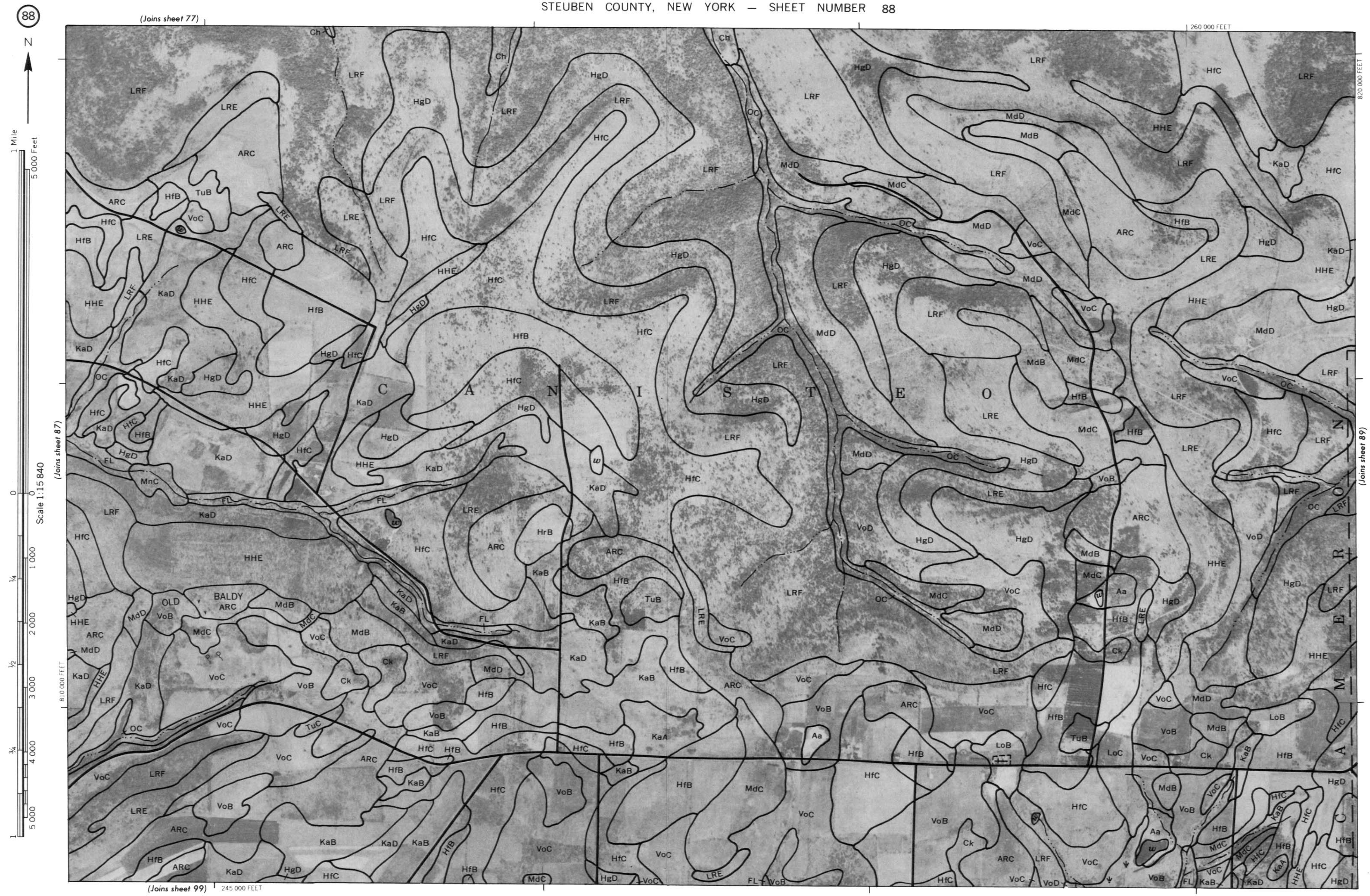
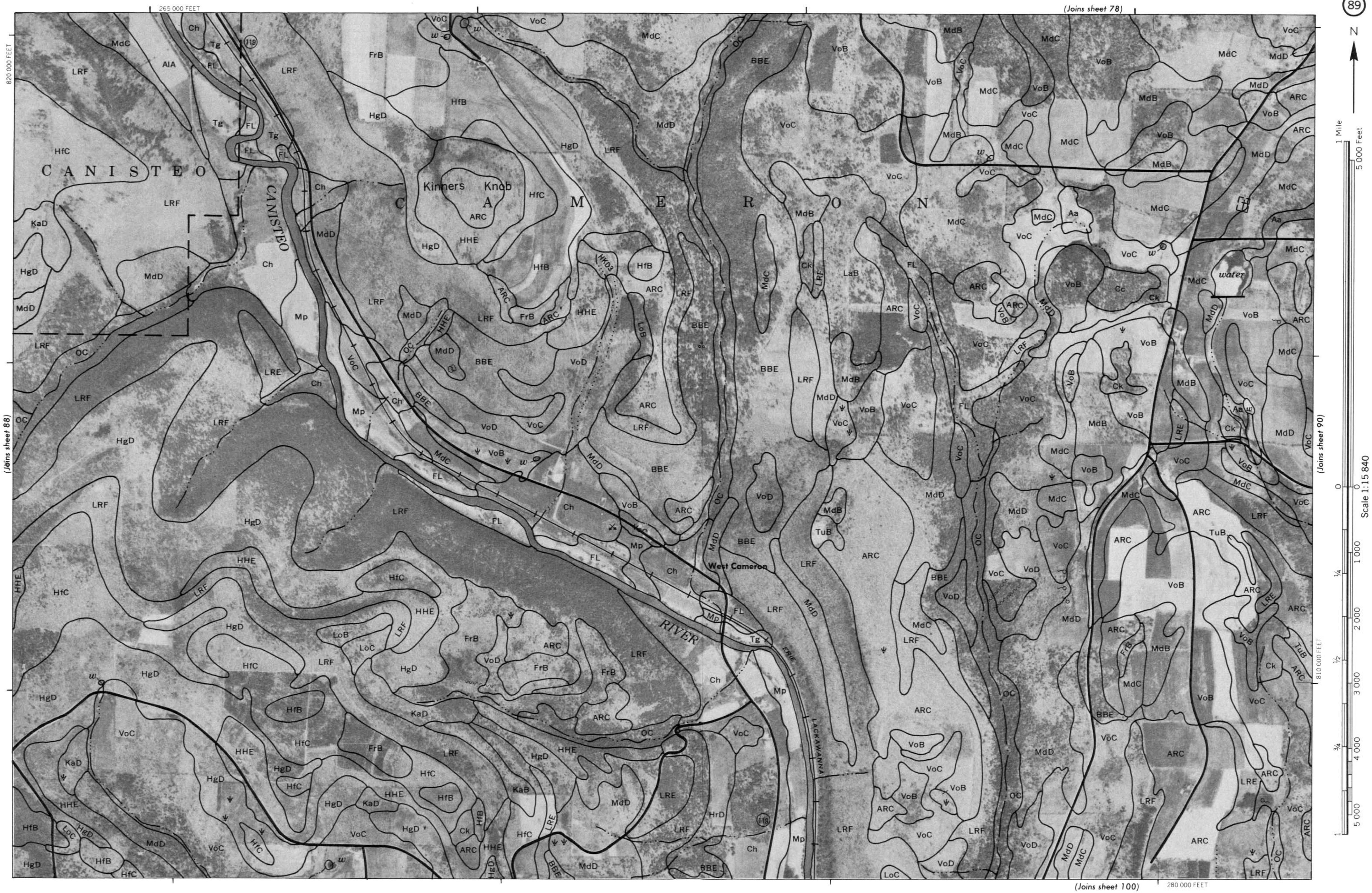


This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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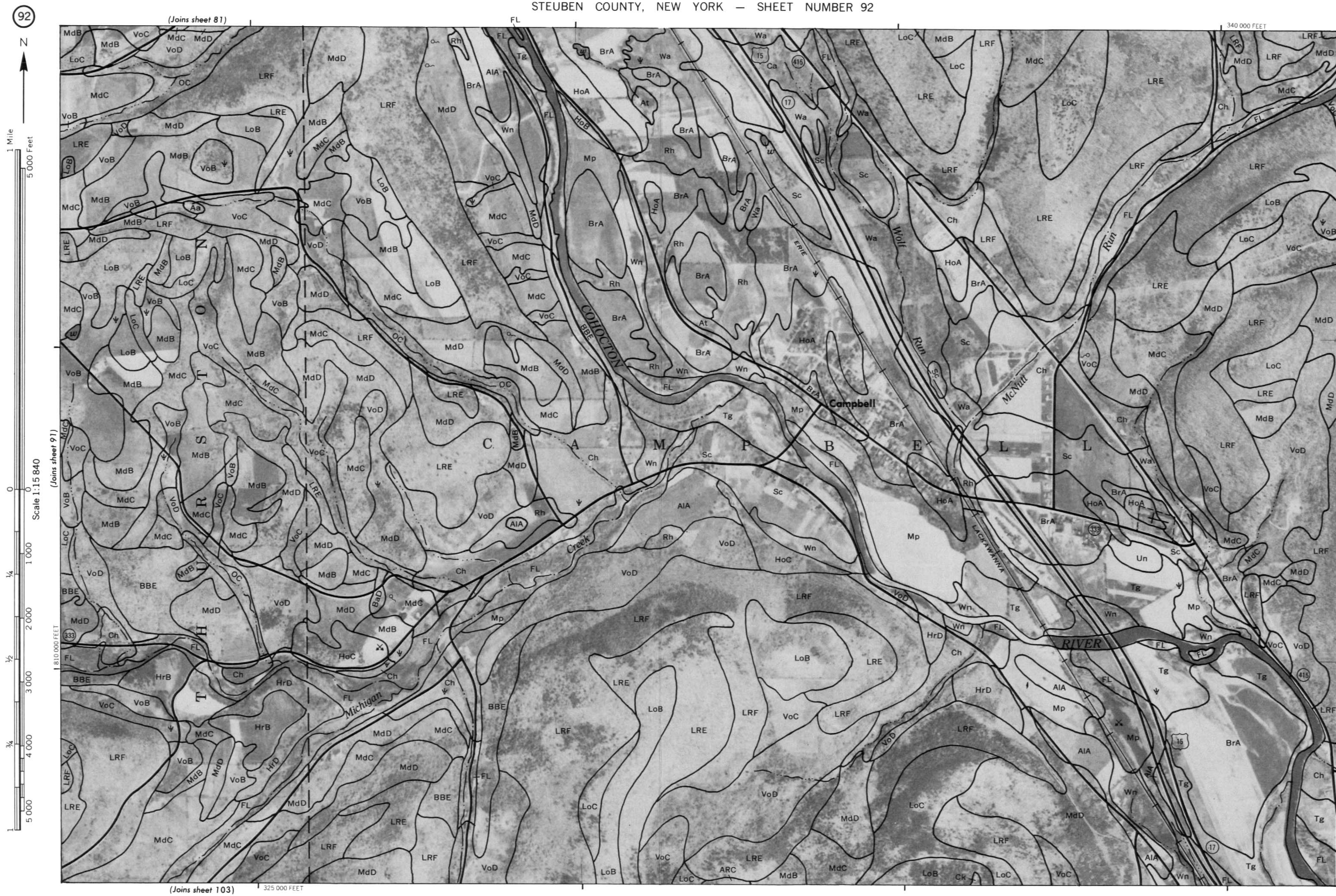

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 94

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

97

(Joins sheet 86)

(Joins sheet 96)

(Joins sheet 98)

(Joins sheet 108)

N

1 Mile

5 000 Feet

Scale 1:15 840

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


98
N
(Joins sheet 87)
(Joins sheet 97)
(Joins sheet 99)
(Joins sheet 109)
240 000 FEET
805 000 FEET
225 000 FEET
795 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
C A N I S T E O
J A S P E R
South Canisteo
BUSH HILL
HILL
COLONEL BILLS CREEK
Dennis Creek
Milwaukee Creek
JACKSON
GRASS HILL
36

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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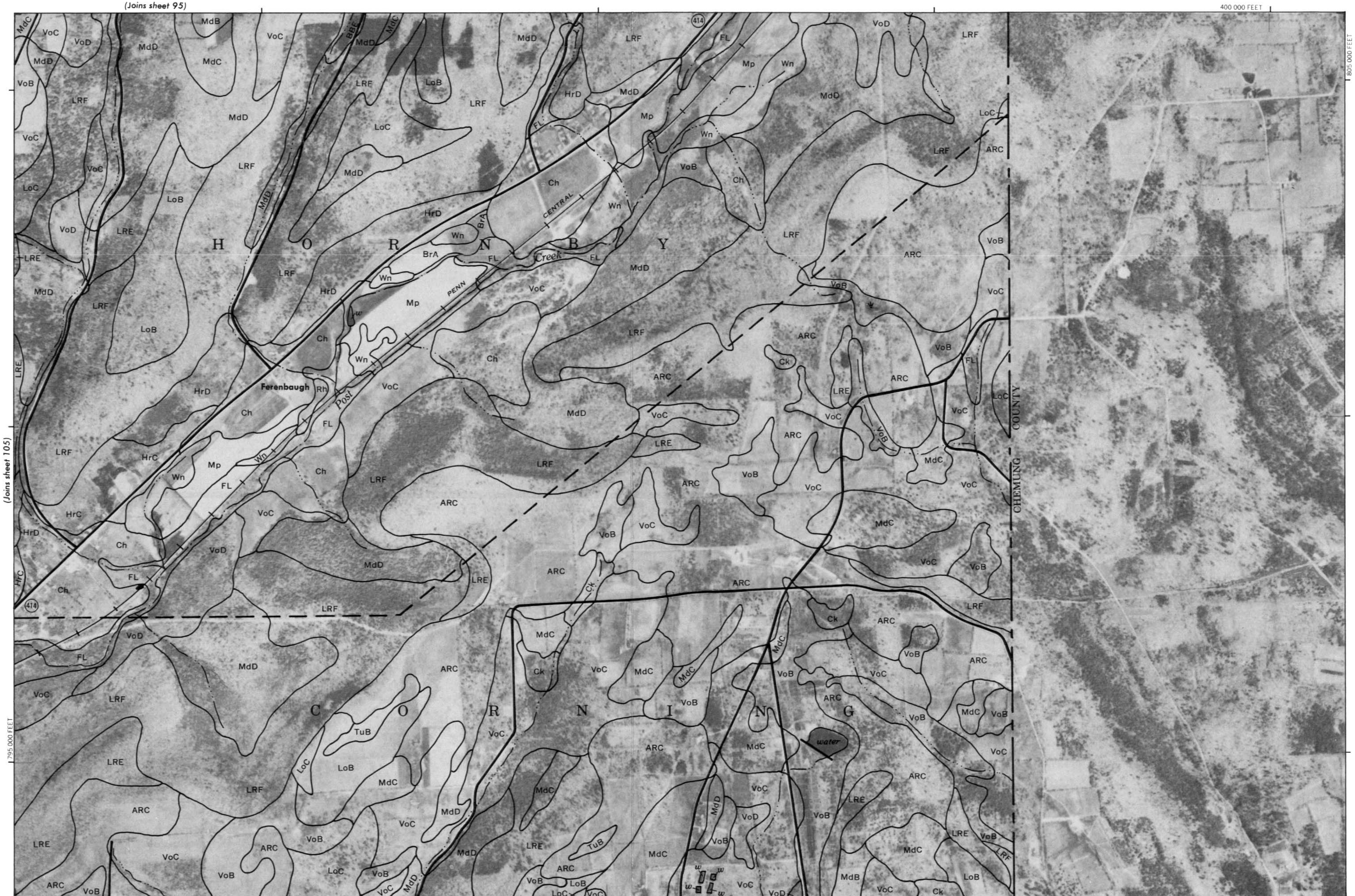
106

N

(Joins sheet 95)

400 000 FEET

805 000 FEET



(Joins sheet 105)

795 000 FEET

385 000 FEET

(Joins sheet 117)

1 Mile
5 000 Feet
0
Scale 1:15 840
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 107

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 108

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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111

(Joins sheet 100)

265 000 FEET

(Joins sheet 110)

(Joins sheet 112)

(Joins sheet 122)

790 000 FEET

785 000 FEET

280 000 FEET

N

1 Mile

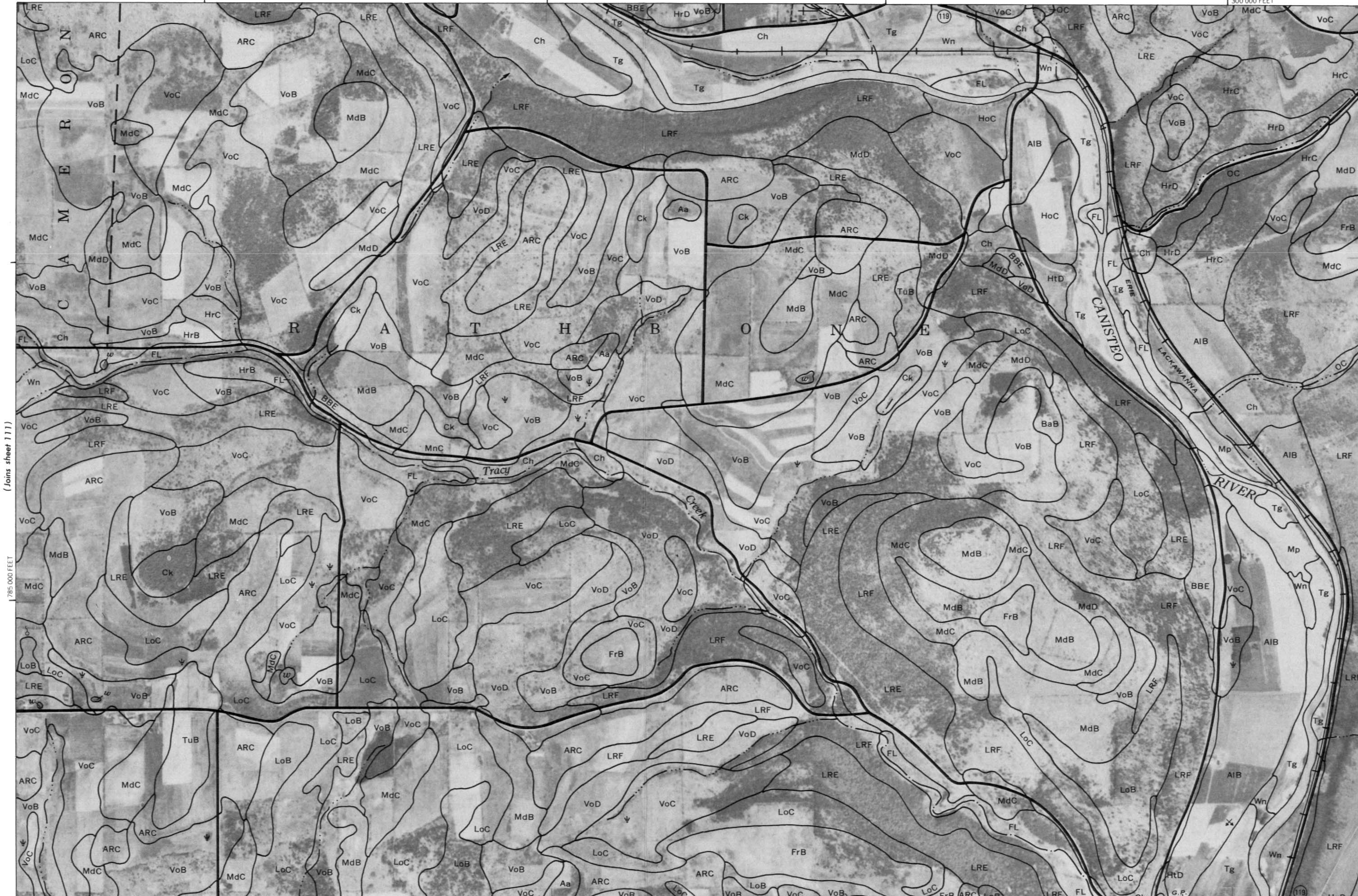
5 000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

1 Mile
5 000 Feet
Scale 1:15 840
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

113

N

(Joins sheet 102)

(Joins sheet 112)

(Joins sheet 114)

(Joins sheet 124)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 Mile

5 000 Feet

Scale 1:15 840

114

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 114

(Joins sheet 103)

340 000 FEET

N

1 Mile

5 000 Feet

0 0

Scale 1:15 840

1 000

¼

2 000

½

3 000

¾

4 000

5 000

1

(Joins sheet 113)

785 000 FEET

790 000 FEET

(Joins sheet 115)

(Joins sheet 125)

325 000 FEET

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 118

(Joins sheet 107)

(Joins sheet 119)

(Joins sheet 129)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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STEUBEN COUNTY, NEW YORK — SHEET NUMBER 120

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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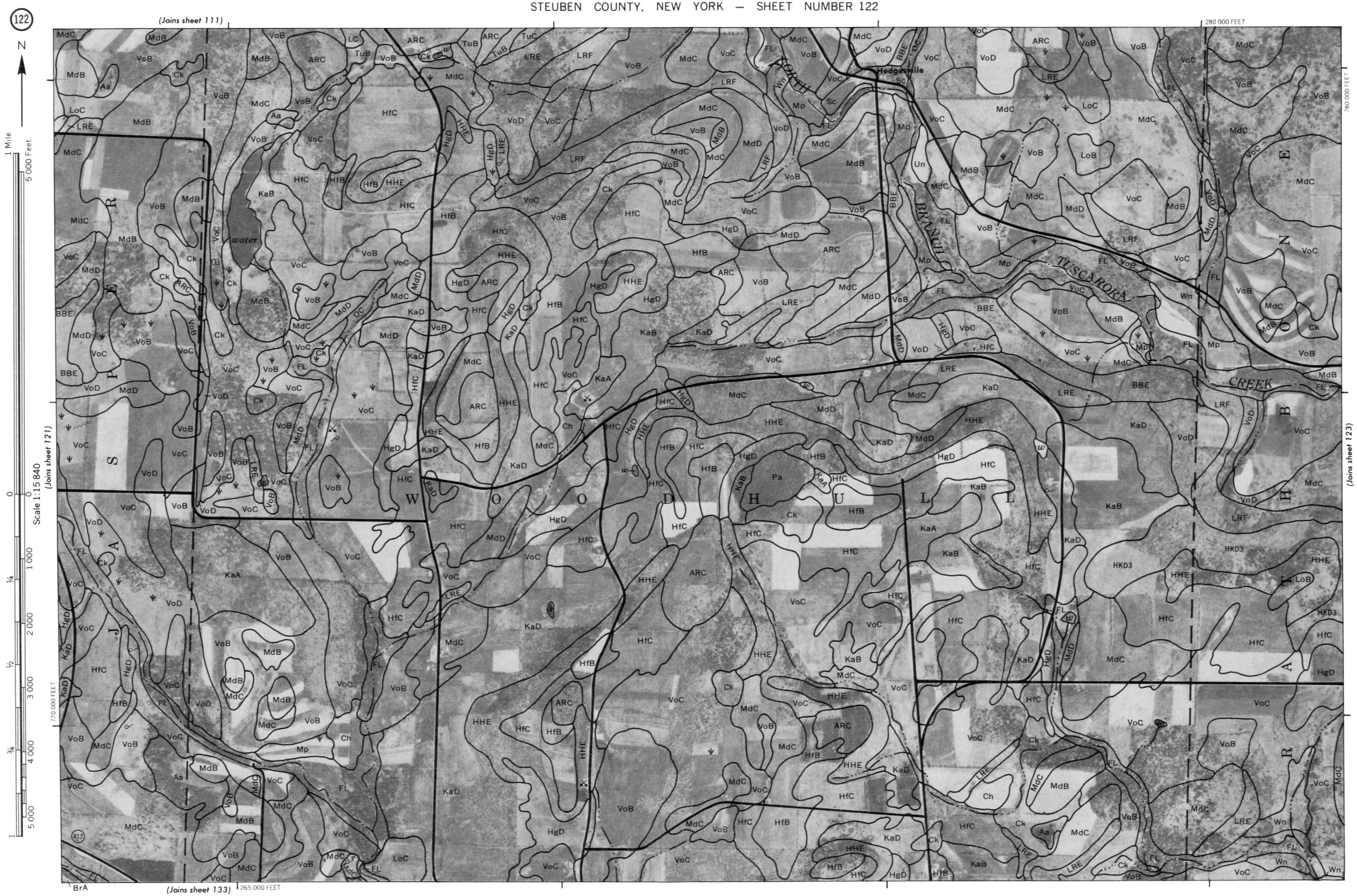
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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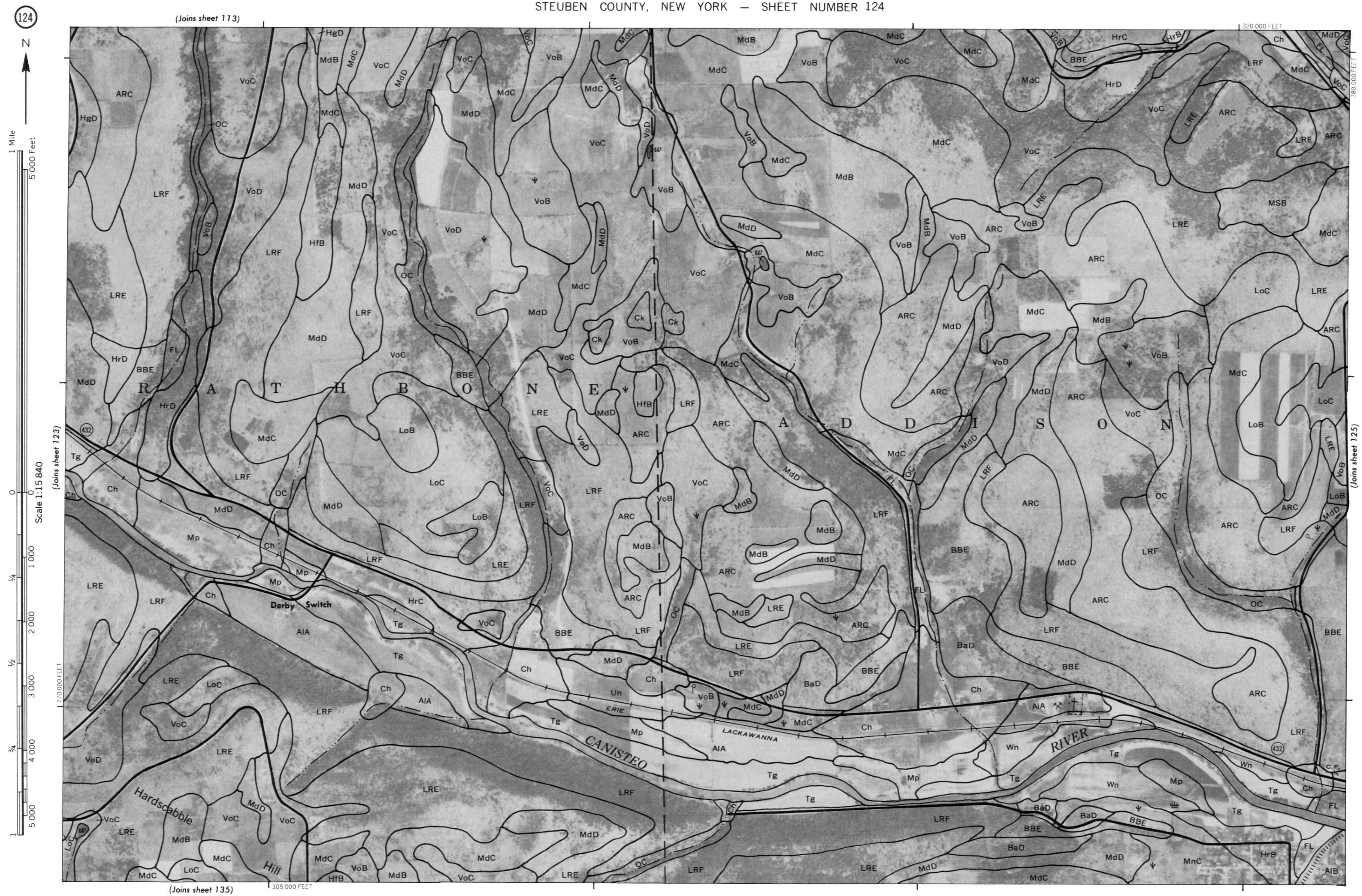
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 124

(Joins sheet 113)



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

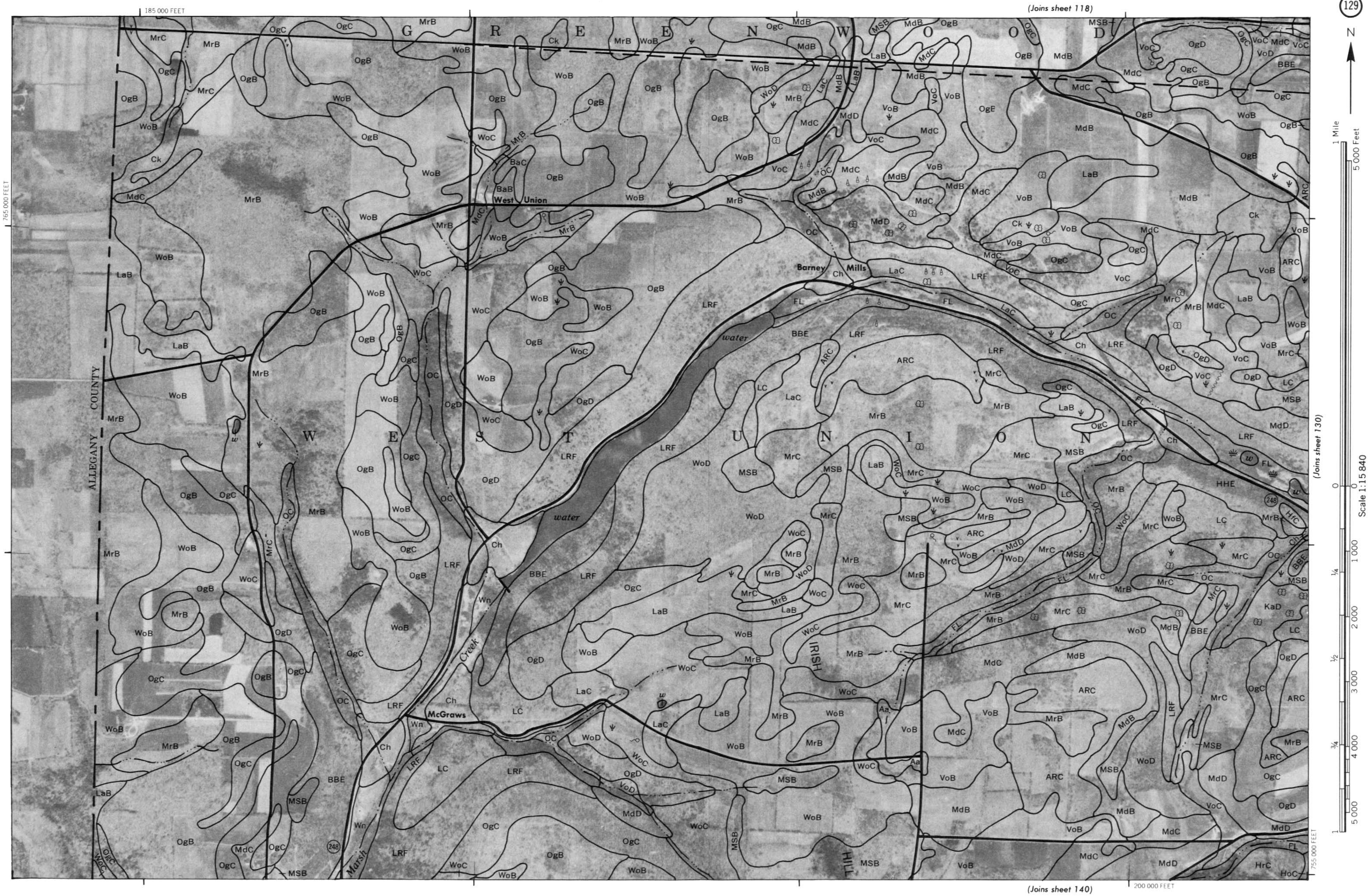

(Joins sheet 116)
(Joins sheet 126)
(Joins sheet 128)
(Joins sheet 138)
360 000 FEET
380 000 FEET
780 000 FEET
770 000 FEET
CORNING
C O R N I N G
E R W I N
South Corning
CHEMUNG
RIVER
Creek
Whiskey
ERIE
LACKAWANNA
C.F.
water
225
17
N
1 Mile
5 000 Feet
Scale 1:15 840
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.
LoB
LoC
LRE
LRF
VoC
VoB
VoD
MdB
MdC
MdD
Ck
FL
BBE
ARC
TuB
Tg
Ch
Un
HrD
HrC
HrB
KaB
AlB
Rh
Mp
LC

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 128

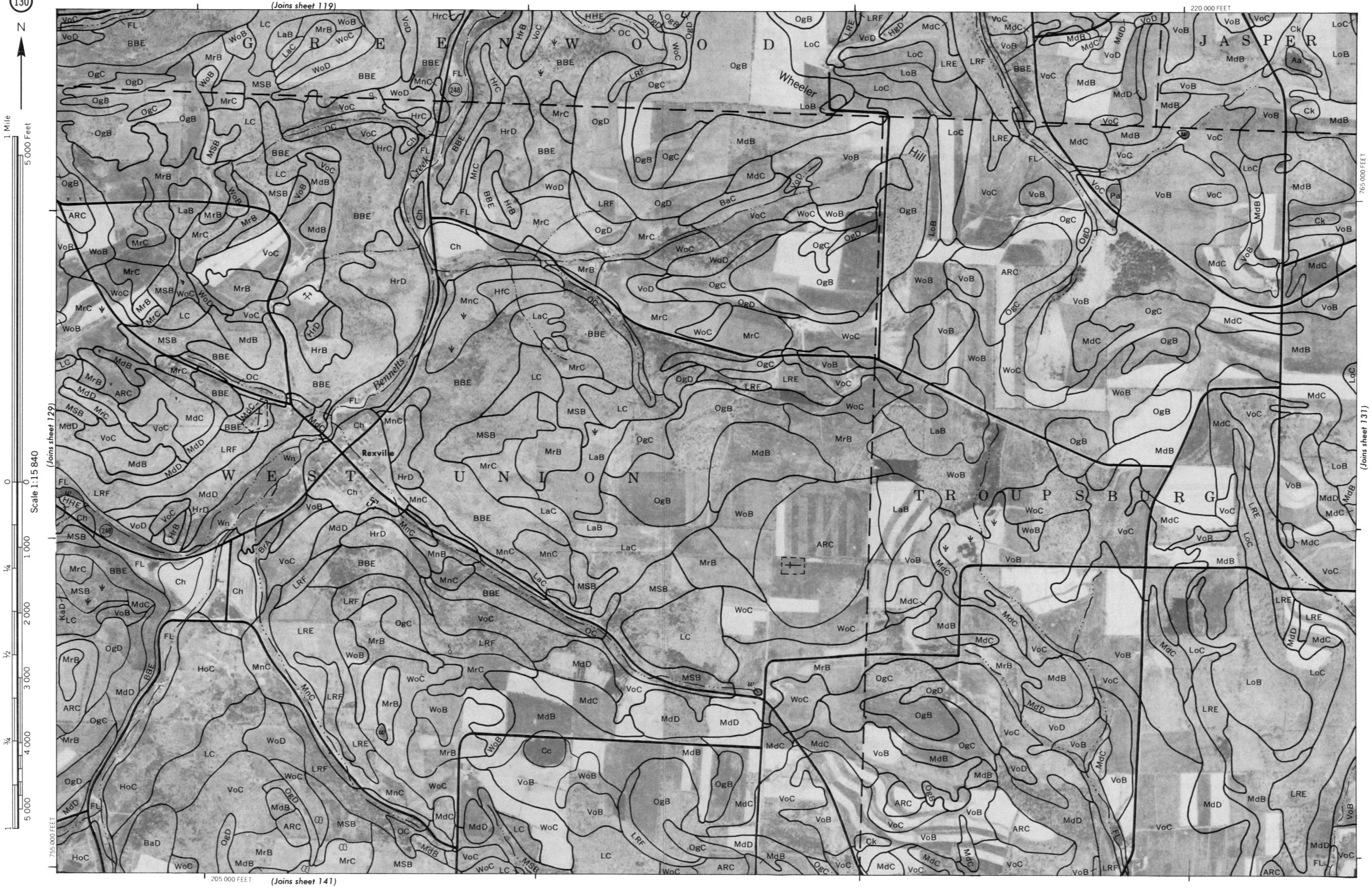
(Joins sheet 117)

(Joins sheet 139)

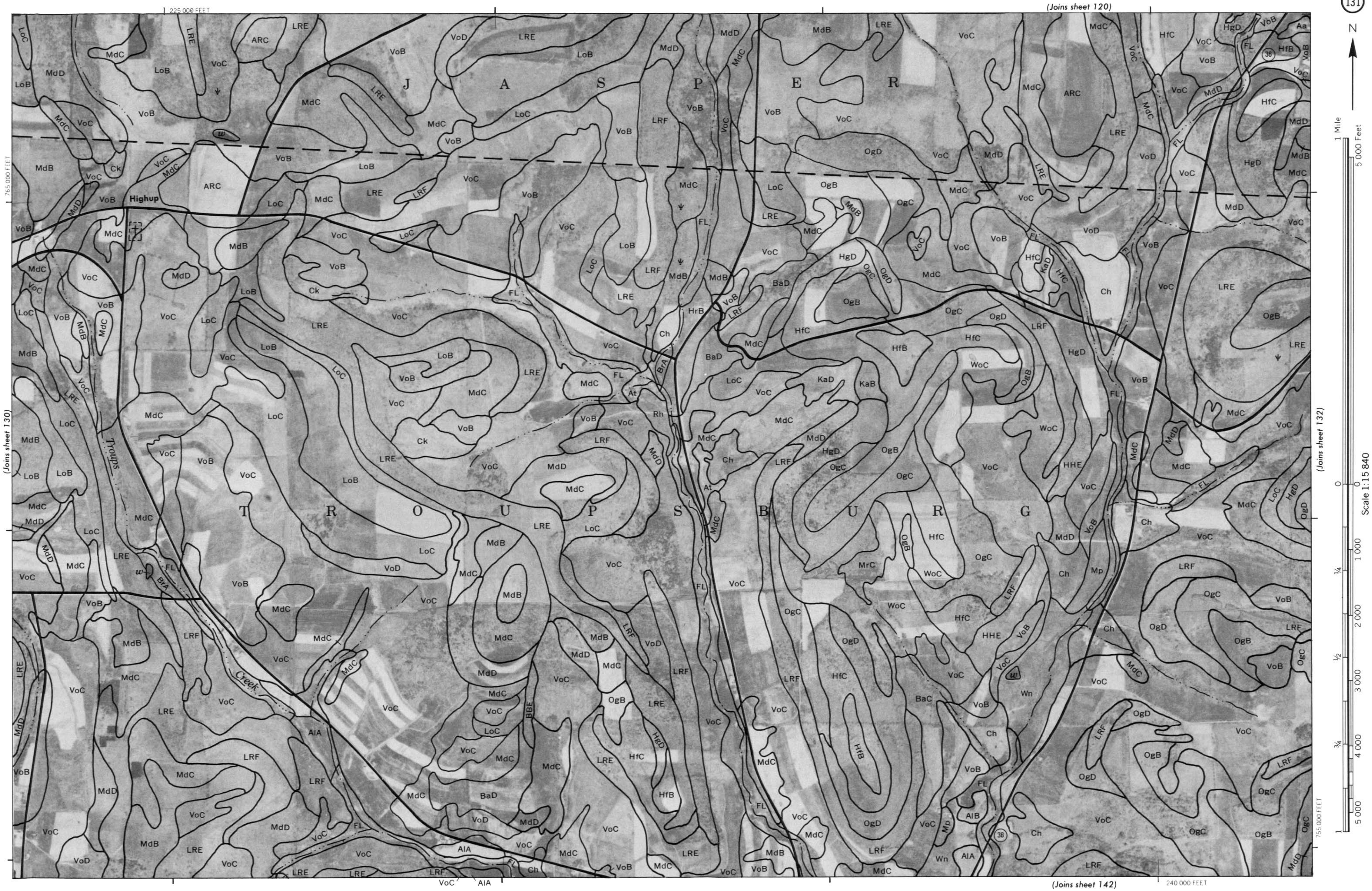
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



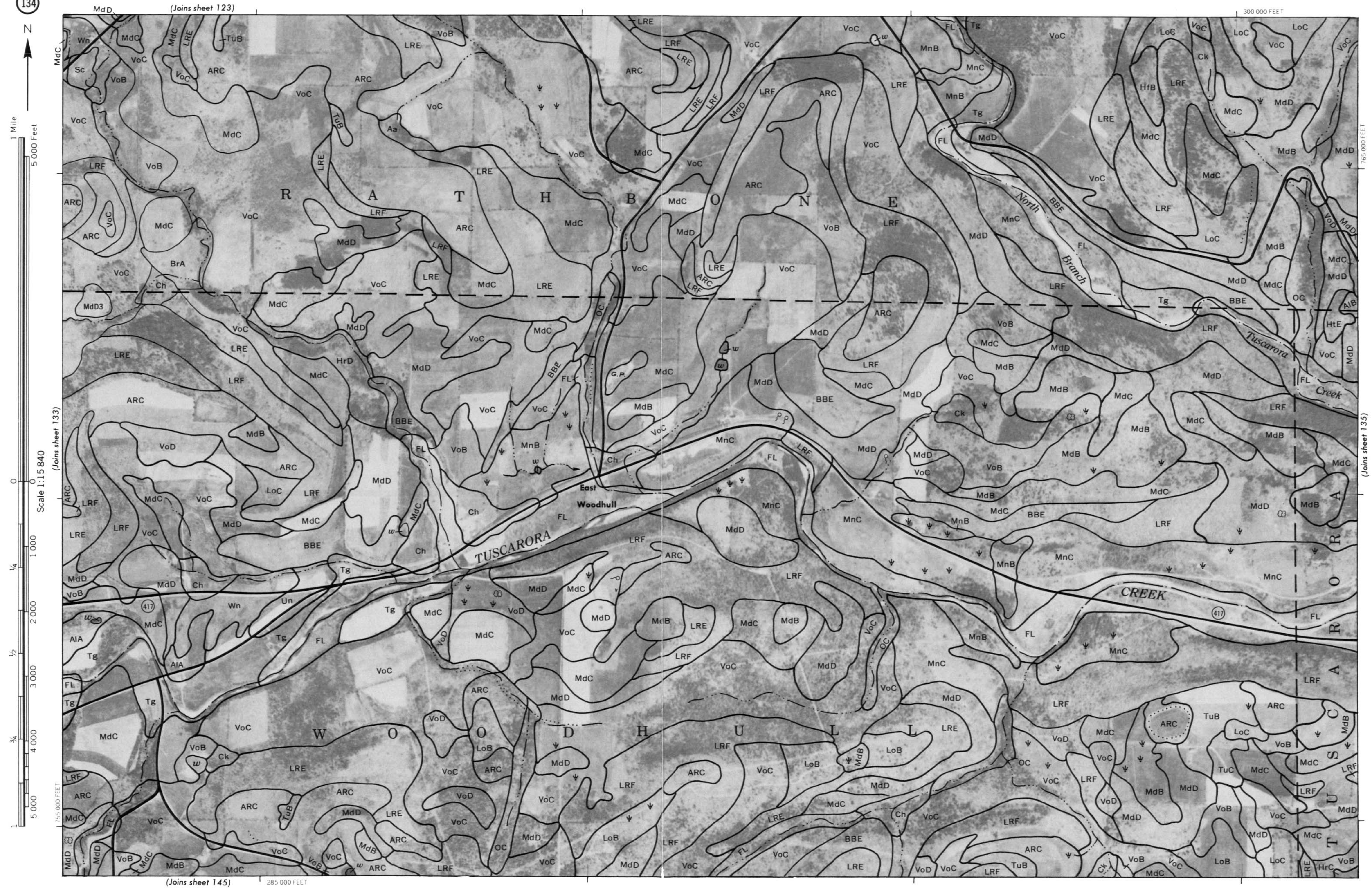
This map is compiled on 1971 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

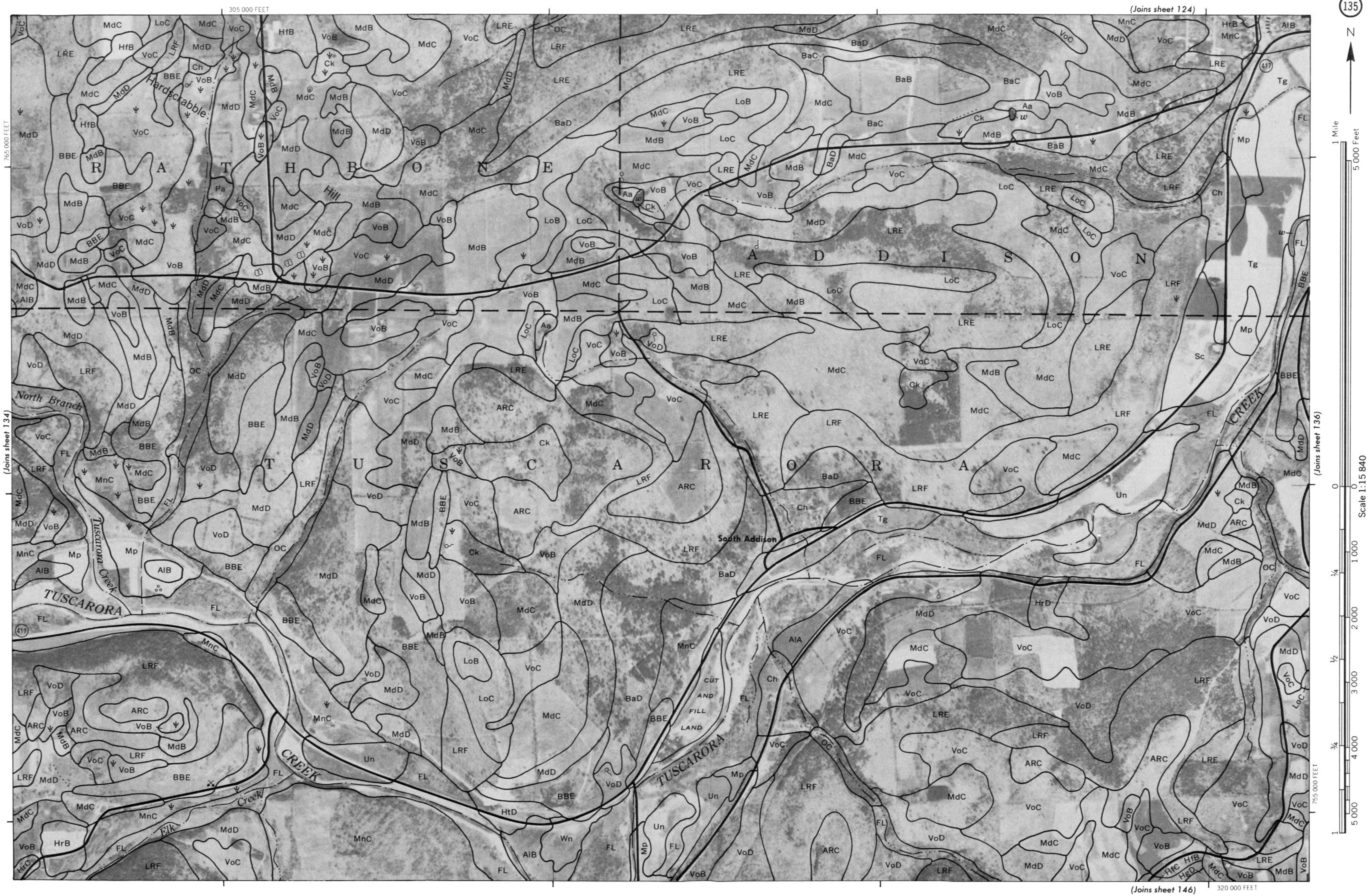


This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


132
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1000
¼
2000
½
3000
¾
4000
5 000
1
(Joins sheet 121)
(Joins sheet 131)
(Joins sheet 133)
(Joins sheet 143)
260 000 FEET
765 000 FEET
755 000 FEET
245 000 FEET
J A S P E R
T R O U P S B U R G
This map is compiled on 1977 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


134
N
(Joins sheet 123)
(Joins sheet 133)
(Joins sheet 135)
(Joins sheet 145)
300 000 FEET
765 000 FEET
285 000 FEET
755 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000
R A T H B O N E
W O O D H U L L
T U S C A R O R A
East Woodhull
TUSCARORA
CREEK
Tuscarora Creek
North Branch
417
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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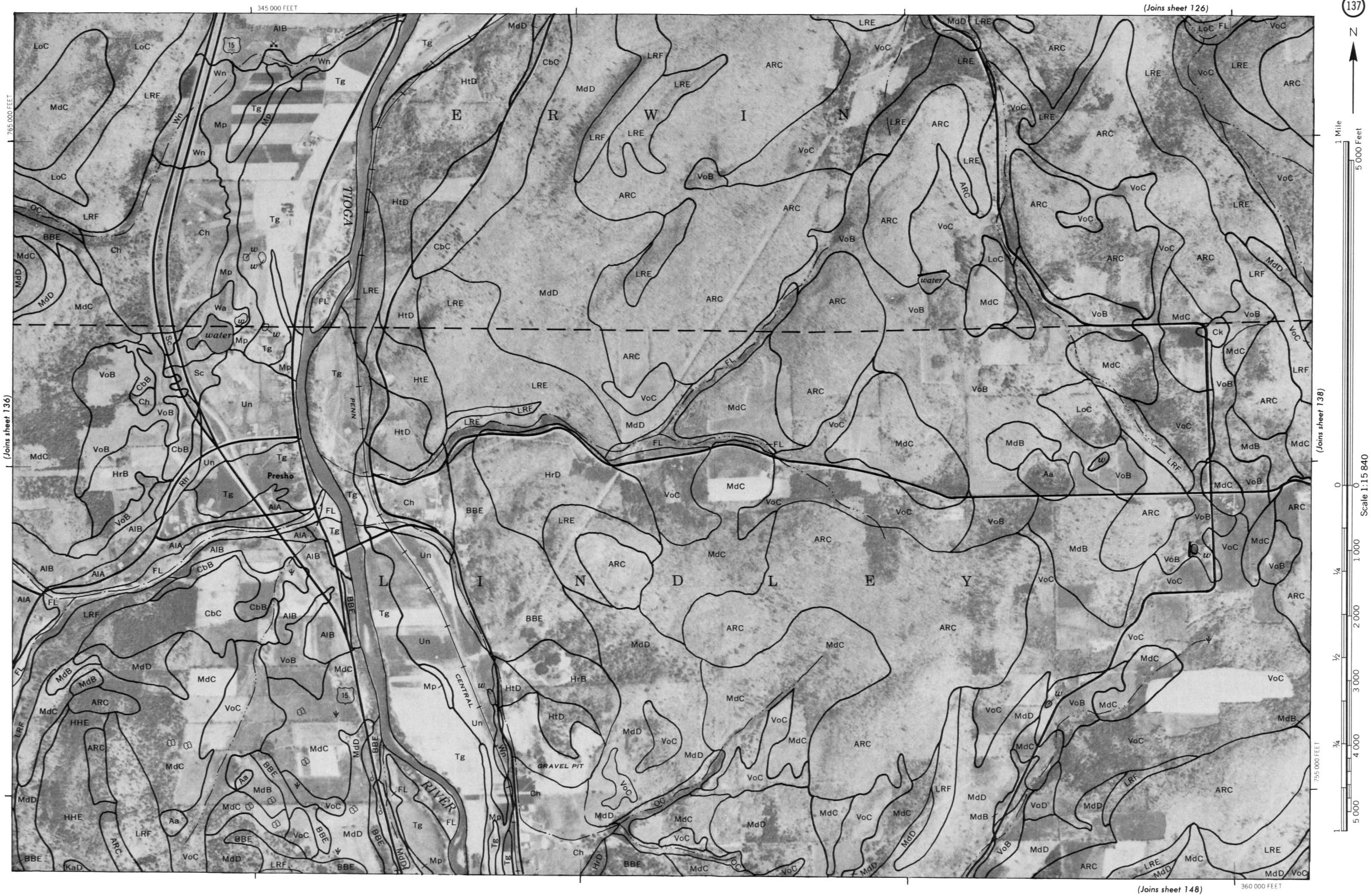

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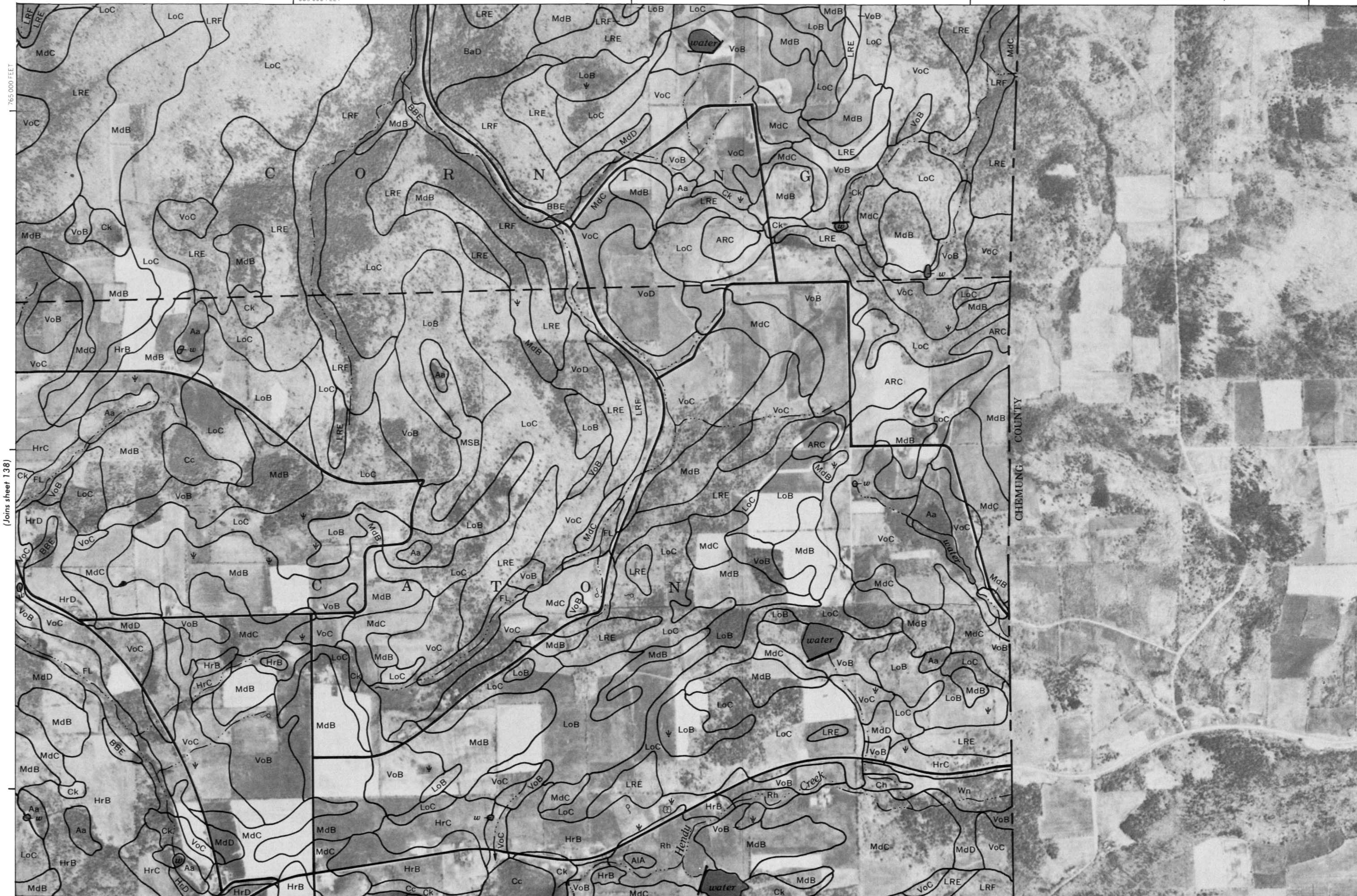
STEUBEN COUNTY, NEW YORK — SHEET NUMBER 138

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 128)



N

1 Mile

5 000 Feet

Scale 1:15 840

0 1 000 2 000 3 000 4 000 5 000

0 ¼ ½ ¾ 1

(Joins sheet 138)

(Joins sheet 150)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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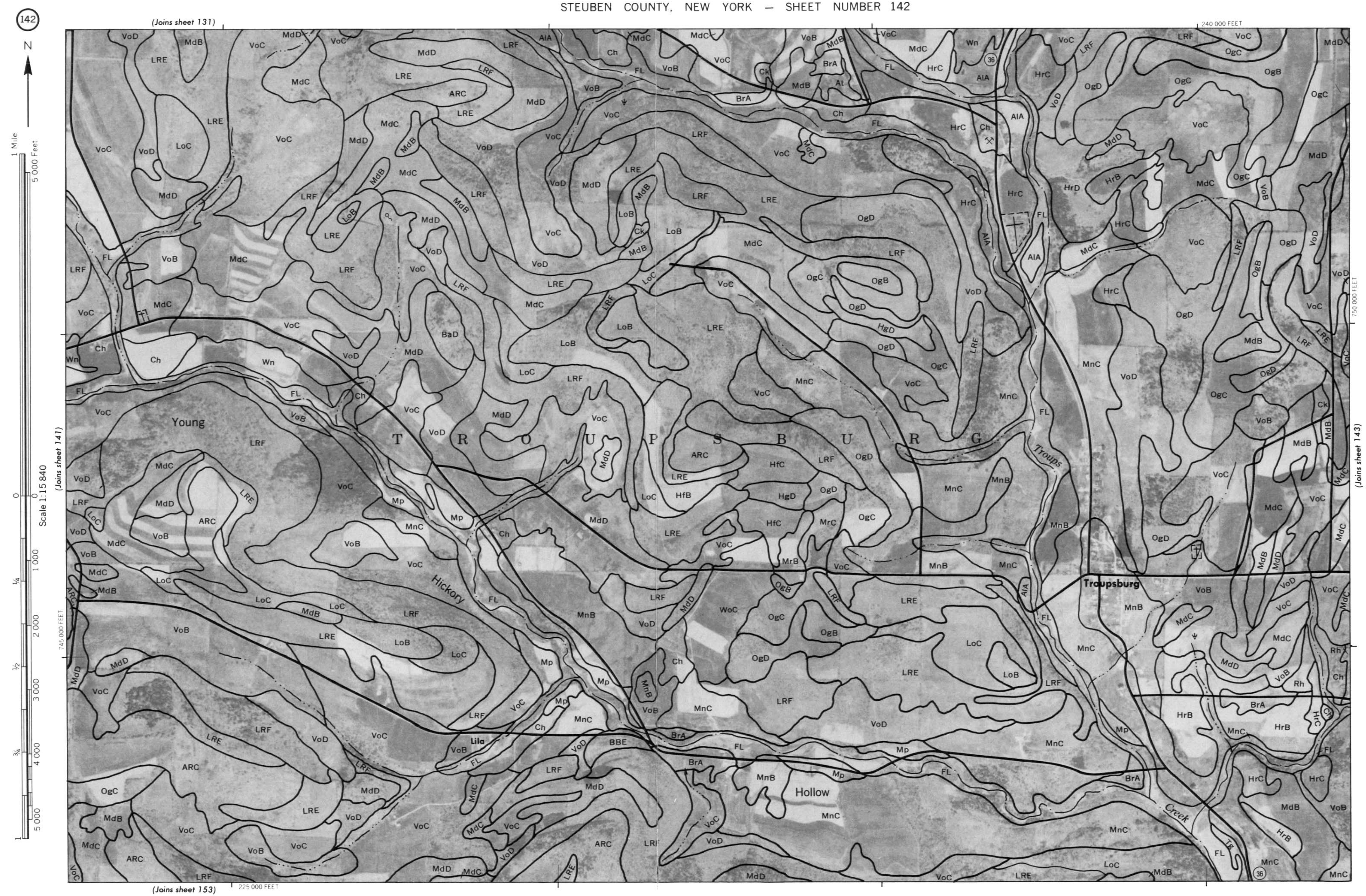
141
N
(Joins sheet 130)
(Joins sheet 140)
(Joins sheet 142)
(Joins sheet 152)
W E S T U N I O N
T R O U P S B U R G
Young Hickory
water
205 000 FEET
220 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840



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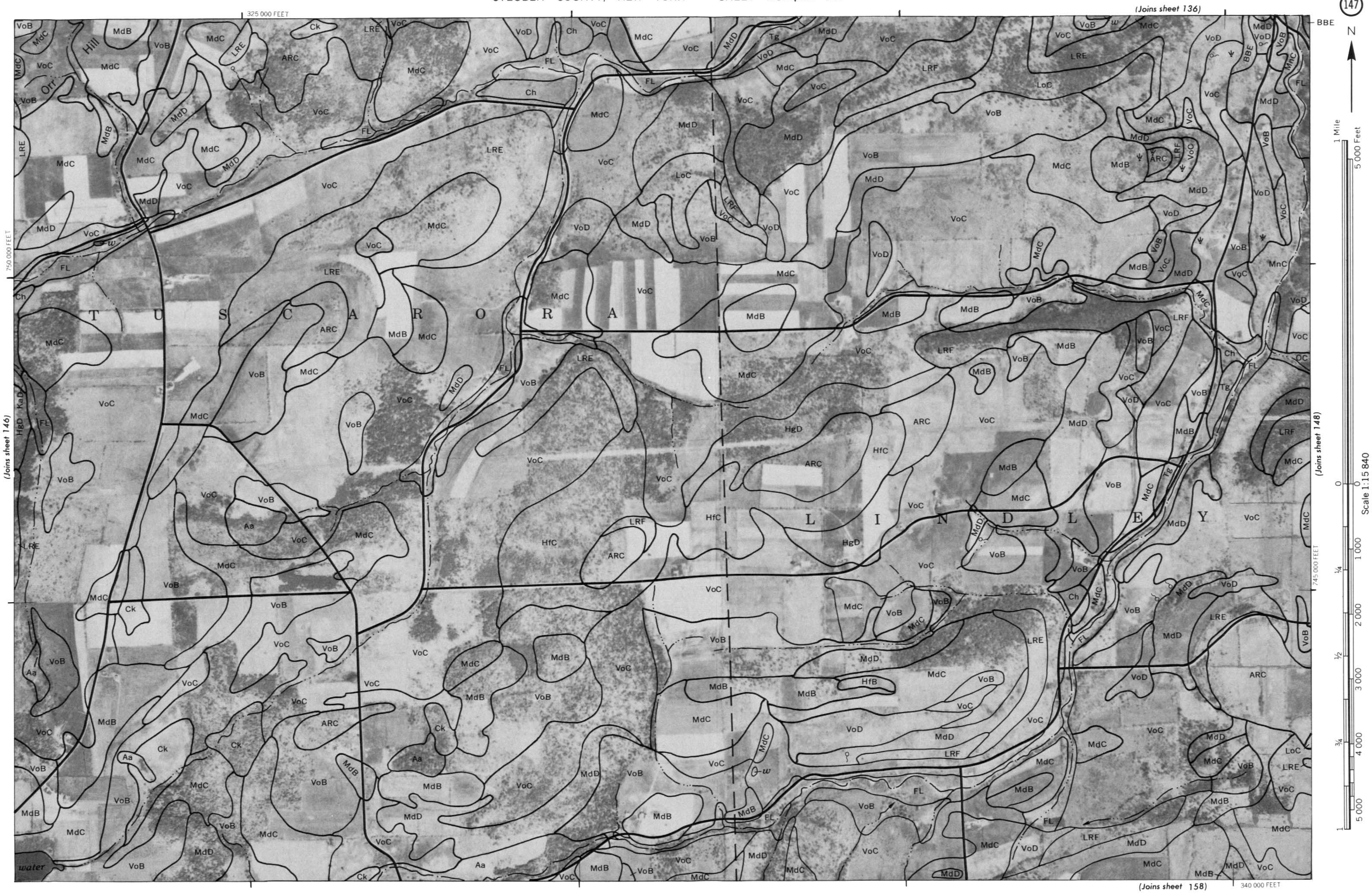
(Joins sheet 133)
(Joins sheet 143)
(Joins sheet 145)
(Joins sheet 155)
N
Scale 1:15 840
1 Mile
5 000 Feet
280 000 FEET
750 000 FEET
745 000 FEET
265 000 FEET
Tuscarora Creek
South Branch
TROUPSBURG
WOODHULL
water

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


146
N
(Joins sheet 135)
(Joins sheet 145)
(Joins sheet 147)
(Joins sheet 157)
T U S C A R O R A
Freeman
Van Vleet
Woods Corners
320 000 FEET
750 000 FEET
305 000 FEET
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 137)

(Joins sheet 147)

(Joins sheet 149)

(Joins sheet 159)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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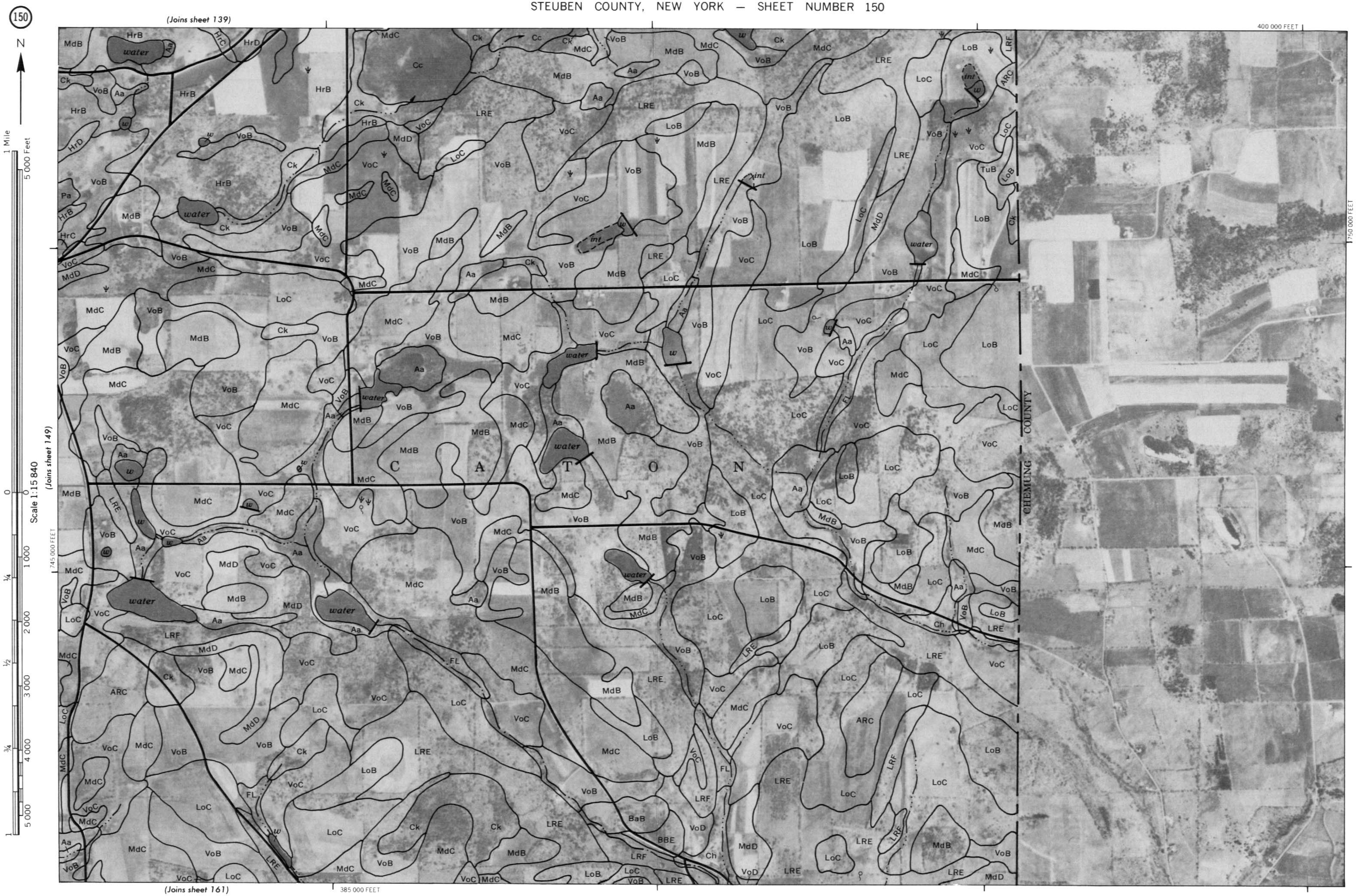

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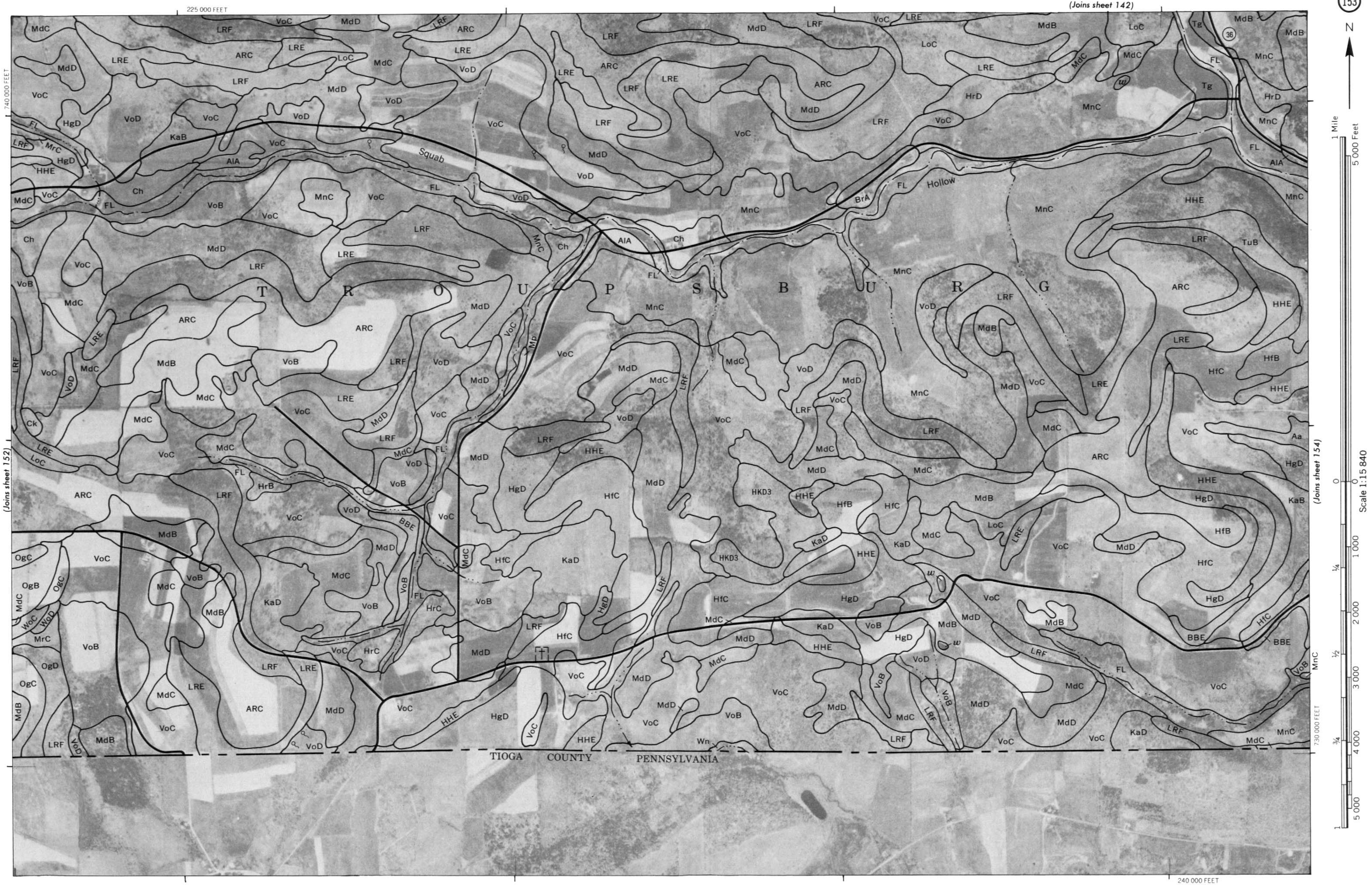
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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N

Scale 1:15 840

1 Mile

5 000 Feet

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(Joins sheet 147)
(Joins sheet 157)
(Joins sheet 159)
N
1 Mile
5 000 Feet
Scale 1:15 840
0
1/4
1/2
3/4
1
0
1 000
2 000
3 000
4 000
5 000
340 000 FEET
740 000 FEET
730 000 FEET
325 000 FEET
T U S C A R O R A
L I N D L E Y
TIOGA COUNTY PENNSYLVANIA


159
(Joins sheet 148)
(Joins sheet 158)
(Joins sheet 160)
345 000 FEET
740 000 FEET
730 000 FEET
360 000 FEET
Lindley
L I N D L E Y
TIOGA
RIVER
PENN
CENTRAL
TIOGA COUNTY
PENNSYLVANIA
N
1 Mile
5 000 Feet
Scale 1:15 840

STEUBEN COUNTY, NEW YORK — SHEET NUMBER 160

N

Scale 1:15 840

1 Mile, 5 000 Feet, 0, 1 000, 2 000, 3 000, 4 000, 5 000, ¼, ½, ¾, 1

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STEUBEN COUNTY, NEW YORK — SHEET NUMBER 161

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